RECREATIONS

IN

PHYSICAL GEOGRAPHY:

OR,

THE EARTH AS IT IS.



BY

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PREFACE.

On a former occasion, we laid before our readers a concise view of Geology, or the Earth in its former condition; the object of the present volume is to offer a general outline of the Earth as it is.

Geology may be compared to Ancient History, around which, distance of time and partial obscurity throw the halo of classical interest. Physical Geography, on the other hand, resembles Modern History, or rather, perhaps, records of daily recurring events, —events in which our own personal interests are concerned. And should it be thought that our present subject does not possess the peculiar charm with which antiquity invests the science of Geology, it will be found, that it does not yield to that, or to any other, in importance, or in the interesting views it unfolds.

Our design being to give a general outline of the Earth in its present condition, both as regards the laws by which it is governed, and its more striking natural features, it has appeared to us, that this end would be more effectually attained by uniting Physical with Descriptive Geography. We have, therefore, not confined our attention to the subjects usually embraced in treatises on Physical Geography, but have superadded a brief description of the leading features of the terrestrial globe, collated from the

most modern and authentic sources. And it is hoped, that by this arrangement each branch of our present subject will tend to elucidate the other; and, that not only will the science of Physical Geography appear in a new and very generally interesting light, but also, that a more comprehensive view of the Earth as it is will be obtained; and the desideratum of a concise and popular outline of Natural Geography in its present advanced state, be in some measure supplied.

It would be an almost endless task to enumerate the various authorities from which valuable information has been derived; but the Author cannot refrain from mentioning more especially, the writings of Whewell, Leslie, and Traill; the Journals of the Royal Geographical Society; MURRAY'S *Encyclopædia of Geography;* and the Reports of Dr. Richardson, Colonel Sykes, and others, to the British Association of Science.

In offering to the Public a new edition of RECREATIONS IN PHYSICAL GEOGRAPHY, it may be desirable to state, that such additions have been made to the work as appear to be called for by the recent progress of discovery.

May, 1842.

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PHYSICAL GEOGRAPHY.

CHAPTER I.

NATURE AND ADVANTAGES OF PHYSICAL GEOGRAPHY.

The great globe itself.—SHAKSPEARE.

FEW subjects connected with science are of more universal interest, or of greater importance to mankind, than that of Physical Geography, and yet few, perhaps, have hitherto so little arrested popular attention. This is, however, a circumstance for which it is by no means difficult to account, being in a great measure, if not wholly, attributable to the comparatively recent elevation of this branch of natural philosophy to the dignity of a science, and to the consequent generally prevailing ignorance of its real objects, of the highly interesting views it unfolds, and of its great practical utility.

The extent to which this misapprehension has been carried, is evinced by the prejudice entertained against the very name of physical geography, which, to some persons, seems to assume a strangely forbidding aspect. Unacquainted with the real character of the subject, they are ready either to reject it as one of abstruse nature, adapted only for the scientific reader, as one of dry detail, and devoid of general interest. The former notion is probably derived from the adoption of the appellation "physical*;" but the whole of this apparent obscurity

* Possibly we shall not err if we attribute a certain portion of this prejudice, to the long and common application, or misapplication, of the term "physic" to medical preparations, in which sense it is now, however, nearly exploded. This acceptation of the term probably owed its origin to the use of "simples," or natural productions, as medicaments,—the physicians being those who employed and administered them. The French use the term *physicien* in a more extended sense, applying it to those whom we should call "natural philosophers."

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vanishes, when we regard this term in its proper meaning of "natural." The notion of the uninteresting character of this science, possibly originates in the commonly received impression of the term "geography." Accustomed to associate the idea of that study with educational books, and with the limited views usually taken in such works, many individuals have little conception of the capabilities of the subject; they are apt to consider, that if they have formed a general acquaintance, with the arrangement of land and water on the surface of the globe, with the position of mountain ranges and rivers, and more especially, with the political divisions of the earth, and the situation of the principal cities and towns, geography has little further to impart. We would by no means be thought to undervalue this department of geographical knowledge,—on the contrary, an acquaintance with the general arrangement of land and water, islands and continents, mountain ranges and lowlands, is essential to the right comprehension of the more extended views embraced by physical geography; and although the latter science does not take cognizance of the artificial divisions of the earth, these will, on many occasions, prove most useful auxiliaries, in assisting us to designate and distinguish any particular localities, which exhibit remarkable phenomena, and to which we are desirous of directing attention. This information is, further, of too great utility in the ordinary intercourse of man with man, and also to the student in history, not to be regarded as highly important; and we pre-suppose our readers to possess this geographical knowledge.

Physical geography directs our attention to the general structure of the terrestrial globe, to the atmosphere by which it is surrounded, and to the distribution of organised beings on its surface. Nor does it stop here; it is not only "a rich storehouse of facts which all other researches supply, a grand repository to which all those facts are referred," but from this vast accumulation of observed phenomena, it attempts to discover the laws by which the whole earth is governed, and to reduce to a few general principles, the infinite variety of appearances displayed in the works of nature.

To arrive at a perfect system of physical geography, we ought, therefore, to be acquainted with the phenomena presented by every portion of the earth, with every animal, every plant on its surface, every mineral contained in its bosom, every variation in its atmosphere.

Pleasant to know, and worthiest to be all
Had in remembrance always with delight;
But what created man can comprehend
Their beauties, or the Wisdom Infinite
That brought them forth, but hid their causes deep!

When we take this view of the subject, so far from regarding it as limited, and as one with which we are already fully acquainted, the best informed cannot but acknowledge their deficiency, and the unlearned might almost be ready to draw back, appalled, not by the obscurity, or want of interest, but by the vastness of the theme. Yet, though it is true that, in its most extended sense, physical geography includes almost every branch of natural philosophy, there is nothing in this science to deter the unitiated from its pursuit. The student is neither called upon to collect facts, nor to draw inferences from facts which have been observed by others,—this has been already accomplished for him; he is merely invited to become acquainted with a few general principles, and to observe the application of these to the works of nature.

Whoever looks abroad into the natural world, cannot but be sensible, that it teems with objects calculated to inspire delight and admiration; nor are any even the least instructed, if gifted with an observant mind, excluded from a participation in these feelings; the Book of Nature is open to all—

She spreads her glories on the earth,
And all her children, from their birth,
Are joint heirs of the whole.
Yea, long as Nature's humblest child
Hath kept her temple undefiled
By sinful sacrifice;
Earth's fairest scenes are all his own,
He is a monarch, and his throne
Is built amid the skies!

Some acquaintance, however, with the laws by which the

universe is governed, tends eminently to increase and elevate the gratification arising from the contemplation of the objects which surround us on every side.

> . . . . Earth has still
> Some traces of her youthful beauty left;

and though the perception of this may be open to all, the harmony and glory of creation can be fully appreciated only by those who are in some measure acquainted with the laws of nature. The study of these laws possesses at the same time, the advantage of fixing the mind on nature's Ruler; for a law not only necessarily implies a lawgiver, but if these laws are found to be uniformly and universally carried into effect, we are further led to the perception of the continually watchful Providence, by which the natural world is governed and sustained; and consequently, to that both of the Omnipotence and Omnipresence of the Deity. We trace the hand of creative wisdom on every side; each object teems also with evidence of the supreme goodness of the Author of Nature; all things appear arrayed in new and beautiful colours, and order and harmony are found to pervade the whole. Science, when thus pursued, is not "falsely so called;" for

> . . . . Philosophy baptized
> In the pure waters of Eternal love
> Has eyes indeed; and viewing all she sees
> As meant to indicate a God to man,
> Gives HIM the praise, and forfeits not her own.

The practical advantages to be derived from physical geography are very considerable, more especially to a nation possessing extensive colonies in various quarters of the globe. It is not every country, nor even every part of a country, that possesses equal advantages for the habitation of man; on the contrary, most countries are naturally divided into a smaller or larger number of parts, materially differing in climate and natural productions, some portions being usually more favoured by nature than others. Diversified, however, as is the surface of the earth, a general agreement is observed to prevail in corresponding climates and situations; and thus, if we are

acquainted with the facts relative to one country, or to a certain portion of the earth's surface, we may form some general idea of the capabilities of any other portion, similarly, or nearly similarly, circumstanced. Physical geography, by taking into account all these agreements and diversities, and by deducing from various phenomena, actually observed in some particular localities, the class of phenomena likely to occur in others, is, in its practical application, of the greatest utility; for it thus enables us to judge of the fitness of any country to provide man with food, and consequently for his habitation; and forms a guide to direct the settler in the choice of the place in which to fix his abode, and also in the selection of crops, adapted to succeed in the region in which his lot may be cast. Ignorance on these points, has led to much disappointment and many futile attempts, and there can be little doubt that the more this science is generally known, the less liable shall we be to meet with failure.

Almost every region of the globe is provided with vegetable productions, all of which require certain conditions to arrive at perfection. Thus, some will thrive in a moist, some in a dry climate; some in the hot regions of the earth, some in the cold, and some only in the temperate,—the greater portion being naturally confined within certain limits. By cultivation, man has been enabled to extend the natural limits of numerous species of plants, and to give them a wider range on the earth's surface. This, however, can only be advantageously effected, by attending to the conditions they require of soil, temperature, and moisture. An acquaintance with such particulars, and with all the circumstances under which valuable plants will succeed, becomes, therefore, of paramount importance to all settlers in distant or newly acquired lands; nor is it without its utility, in any attempts to introduce new species into our own country.

The narratives of travellers, their surprising adventures, the wonders they relate of distant lands, form, both in our earliest youth, and also in more mature age, some of our most favourite works of recreation. In imagination we accompany the enter-

prising wanderer across the wide ocean, with him ascend the lofty and snow-clad mountain, and trace the river to its source, or descend into the fertile valley, clothed with rich vegetation, and watered by the broad spreading stream; we traverse the parched and sandy desert, or penetrate into the dense forest; we meet with numberless and varied tribes of animals and plants, some approaching in character to the productions of our own land, others presenting new and singular forms. Such descriptions of small and detached portions of the earth's surface, kindle in us a desire to become acquainted with all that is remarkable on the face of the globe; in short, with all that descriptive geography (for such in fact it is, though perhaps, little thought of under that name,) can impart to us. Nor will the inquiring mind rest here; it will further aspire to obtain some knowledge of the causes which give rise to the various phenomena thus brought before its view, and of the laws by which they are governed. Here then physical geography comes to our aid; and not only does it afford an explanation of remarkable phenomena of rare occurrence, displayed, perhaps, in some remote region of the globe, but also of various familiar but interesting facts in natural history, daily passing before our view, though not unfrequently almost without notice, and without our having any perception of the constancy of the laws by which they are governed.

This science, therefore, is very excursive in its range, not only directing our attention to the more striking and wonderful, because more uncommon, phenomena of the natural world, but leading its student to observe and to reflect, to derive subjects for thought and admiration from all that surrounds him; thus enhancing his pleasure, both in the perusal of every description of the earth's surface, and in the contemplation of all the works of creation. Evident traces of beneficent design present themselves on every side,—the student himself may perceive them; the more he knows the more does he wish to know,—his spirit becomes athirst for knowledge; and it is well that it should be so,—for

The desire which tends to know
The works of God, thereby to glorify
The great Work-master, leads to no excess
That reaches blame, but rather merits praise
The more it seems excess."

He has entered on a vast and inexhaustible field, full of treasures, which those who seek shall find, hidden treasures of wisdom, power, and goodness: and if these are pursued with a proper spirit, he will learn that "the mind employed on that which is great, becomes itself greater."

CHAPTER II.

THE EARTH; ITS POSITION IN THE UNIVERSE, FIGURE, MAGNITUDE, AND DENSITY; GENERAL STRUCTURE OF ITS SURFACE. —PHENOMENA OF EARTHQUAKES AND VOLCANOS.

. . . . This earth, a spot, a grain,
An atom, with the firmament compared,
And all her numbered stars. YOUNG.

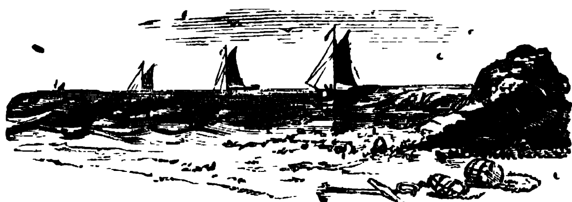
THE earth belongs to a system of planetary bodies, of which the sun forms the centre, and which is hence termed the solar system. We are at present acquainted with eleven principal or primary planets, which revolve round the sun, and eighteen secondary planets, called moons, or satellites, revolving round the planets of which they are the attendants. The orbit of the earth, or path in which it moves round the sun, is elliptical, though it differs very little from a circle; the mean, or average distance of the earth from the sun, being ninety-five millions of miles.

The earth is of a globular form; its figure, however, is not that of a perfect sphere, but somewhat elliptical, or flattened at the poles, though the flattening, or difference of diameter, is so trifling, "that if a model of similar proportions were turned in wood," says Sir John Herschel, "and placed before us on a

table, the most correct eye or hand would not detect the deviation from the spherical form."

The globular form of the earth is proved by the circumstance that ships steering in a general direction, either eastward or westward, arrive again at the point of departure. Few individuals, it is true, have it in their power to verify this in their own experience, but there is another mode of observation, by which many may have the opportunity of actually perceiving the *shape* of the earth; this cannot, however, be accomplished with certainty on land,—the hills, trees, and other objects, which diversify its surface, and break and vary the line of the horizon, although bearing a most minute proportion to the whole earth, are, nevertheless, too considerable with respect to ourselves, to admit of our forming any judgment of the whole. But with the surface of the sea the case is otherwise; if we stand upon the sea-shore, we observe the surface of the ocean, not losing itself in misty distance, but terminated by a sharp, clear, well-defined line, or *offing*, as it is called, which constitutes the visible horizon. If we sail out of sight of land, this offing extends in a circle round us, of which our station in the vessel forms the centre. The appearance of this visible horizon, or sea-offing, is a consequence of the curvature of the surface.

That such is the case, is in fact proved by the phenomena exhibited by vessels receding from the shore, and sailing beyond our visible horizon.



The vessel, as it recedes, diminishes in size, but the whole is visible, until it reaches this water-line. Beyond this, though

the masts and sails still remain in view, the hull of the ship is below the horizon; the portion of the ocean on which it is floating, being concealed from our view by the spherical surface of the sea, which protrudes between the hull and ourselves. If the vessel proceed a little further, the lower sails disappear, and only the upper are descried; and at length the whole is lost to our view. If, however, we immediately ascend some eminence, (the mast of a ship, if at sea—a tower, or the upper rooms of a house, if on land,) the vessel will again be visible, the elevation we have reached enabling us to see to a greater distance; and this will be in exact proportion to the height above the water, both of the object and of the observer. It is on this principle that, when a vessel is outward-bound, and—

> The sailor sighs as sinks his native shore,
> And all its lessening turrets bluely fade:
> *He climbs the mast* to feast his eyes once more.

When the eye is elevated six feet above the water, an object may be seen on its surface at the distance of three miles. Two points, each ten feet above the level of the water, cease to be visible to each other at a distance of eight miles. If we ascend any great elevation, such as the Peak of Teneriffe, Mowna Roa, (in the island of Hawaii, one of the Sandwich group,) or any other mountain commanding a vast extent of ocean, the distance at which any object is visible is proportionably increased, and the observer commands a much larger portion of the earth's surface. Thus, from the Peak of Teneriffe, or from Mowna Roa, a four-thousandth part of the whole surface of the earth is visible. The greatest extent of the earth's surface ever seen at once by man, was that displayed to the view of MM. Biot and Gay Lussac, in their celebrated aëronautic expedition, to the height of 22,900 feet above the sea: the visible area, in this case, having been a sixteen-hundredth of the earth's surface. On ascending to great elevations, while the absolute visible range, or quantity of the surface seen at once, has increased, the apparent size of the earth will have sensibly diminished. The visible horizon invariably

extends in a circle round the observer; the same appearances being observed universally, in every part of the earth's surface, that have been visited by man. Now, the figure of a body, which, however seen, appears always circular, can be no other than a sphere, or globe.

The earth, as already stated, is not a perfect sphere, but a spheroid; its ellipticity, or the deviation in its figure from that of a perfect sphere, being equal to about one three-hundredth part; the compression at the poles being estimated at twenty-six miles in the diameter of the whole earth. Its greater, or equatorial diameter is, therefore, 7926 miles, nearly, and the polar diameter 7899 miles. The equatorial circumference of the earth is a little less than 25,000 miles.

The revolution of the earth on its axis is performed in a natural day, or, more correctly speaking, once in $23^h\ 56'\ 4''$; any point on its equator having a rotatory motion of more than 1000 miles per hour. This velocity gradually diminishes as we approach the poles, where it altogether ceases. In the parallel of London, the rate of this motion is 648 miles in the hour. Whilst

The planet earth, so steadfast though she seem,

is thus revolving on her axis, she has also a progressive motion in her orbit, and is therefore at the same time passing through space with almost inconceivable velocity: for, the length of the earth's orbit being estimated at 600,000,000 miles, her motion must exceed 68,400 miles in the hour.

The subject of the density of the earth has long occupied the attention of the learned. It is supposed to increase towards the centre, the average density of the rocks on the surface scarcely exceeding two and a half times that of water, whilst the mean density of the whole earth is equal to about five times that of water.

The rocks on the earth's surface, are, as we have seen in our review of geology*, divided into two great classes, the aqueous and the igneous. Aqueous rocks are such as appear to have been formed by gradual deposits in water, and to have become

* *Recreations in Geology*, 2nd edition, pp. 30, 31.

more or less consolidated, or hardened into solid rock: such are sandstones, clays, limestones, &c. Igneous rocks are such as appear to have been formed through the agency of heat, by the melting down or fusion of the materials of which they are composed. The principal rocks of this class are granite, basalt, lava, &c.

Granite is a very universally-diffused rock; not that it appears at the surface in every locality, being in many places concealed from our view by beds of aqueous rocks of enormous thickness; but it is supposed to constitute the base on which all other rocks have been deposited. In many places, however, it towers pre-eminently above all other rocks; thus forming the summits of some of the loftiest mountains on the face of the globe.

The aqueous rocks, which are also called stratified, are arranged in three divisions, primary, secondary, and tertiary. The primary are very widely spread over the earth's surface, almost all lofty mountain ranges being in part formed of rocks of this description. They are the principal, though by no means the sole depositories of metallic ores, but are devoid of fossils. The secondary, and tertiary rocks—which again have their appropriate sub-divisions, each characterized by distinct assemblages of organic remains—are of less universal occurrence, and frequently vary in their composition in different localities. Allowing, however, for these local diversities, a general correspondence is observable in the structure and arrangement of rocks in all parts of the earth, and indications everywhere present themselves, that similar agency has been employed in the formation of the whole.

A layer of alluvial soil, or of soil deposited by water, &c., and of recent formation, usually constitutes the upper coating of the earth's surface, especially in plains and valleys. This deposit is chiefly formed of particles abraded, or worn from older rocks, by the action of water, of the atmosphere, or of electricity; the whole surface of the earth being thus in a greater or less degree, in a state of perpetual change.

. . . Within this wide great universe
Nothing doth firme and permanent appeare,
But all things tost and turnéd by transverse.

Water is a very powerful and active agent in altering and variously modifying the surface of the earth. The atmosphere, also, effects great changes on rocks; the differently shaped summits of mountains and hills, owing much of their form to the destroying influence of the weather, which acts with varied effects on differently constituted rocks. Electricity, again, both directly and indirectly, produces an infinity of changes. When we speak of electricity, however, we must not be understood as referring solely to the more striking effects of the electric fluid, but rather to its silent and unobserved operation; which in the economy of nature, is far more important than the former, though vast effects are occasionally produced by lightning. Thus, at Cayamba, in Colombia, about forty years ago, the lightning rent a cliff in its entire length, and precipitated a mighty mass into the river Huallaga, whose course was at the time obstructed: and the river now forces its way with much violence and uproar, through the massive fragments of the shattered cliff.

But it will be evident that the changes produced by the above-mentioned agents (at least in their external operation,) are limited to the wearing away, and consequent lowering of the more elevated parts of the earth's surface, and that all appear to have a tendency to reduce the whole to one general level. We must, therefore, look for some other agent, some opponent force, to counteract these effects, and accomplish the more remarkable work of elevating mountain ranges, and of raising land above its former level. Such is subterranean heat, displayed in the phenomena of earthquakes and volcanos: and probably also, although less obviously, in the gradual rise which is taking place in some regions. That a connexion exists between earthquakes and volcanos, has been proved by several well-authenticated facts; and that both owe their origin to subterranean heat, is generally admitted, though the mode of its operation may be regarded as still involved in

obscurity. The disturbances it produces on the earth's surface, may, however, be regarded as some of the most important phenomena which it belongs to physical geography to describe.*

Some of our readers may, nevertheless, not be aware of the magnificent scale, on which the energy of subterranean heat is at present developed on the surface of the globe; these commotions in the earth's crust, though, on account of the dreadful catastrophes to which they occasionally give rise, almost unavoidably universally regarded as appalling phenomena, being perhaps very generally considered as detached events of rare occurrence; remarkable, it is true, from the destruction of property, and awful loss of life, with which they have, in many instances, been accompanied, but of no further account in the natural world. Nay, in this highly favoured island, we are so far removed from the theatre of volcanic action, that the very circumstance of these powerful agents being continually at work in great force, in various parts of the globe, is perhaps altogether unheeded by many individuals. And thus—

> Some souls there are that live, and breathe, and die,
> Scarce knowing more of Nature's potency,
> Than what they learn from heat, or cold, or rain,
> Or sad vicissitude of weary pain.

Volcanos and the movements of great earthquakes are confined to certain districts of the earth, a circumstance which has led an eminent geologist to designate the tracts where they more especially occur, as *volcanic regions*, or *volcanic bands*. These volcanic regions are continuous tracts, marked by the occurrence, at intervals, of active volcanic vents, often constituting mere spots, thinly scattered over the surface of vast districts, but presenting abundant evidence that subterranean fire is at work in the intermediate spaces, by the earthquakes which from time to time take place. Gaseous vapours also are plentifully disengaged from the soil; petroleum, and other

* The consideration of these phenomena is included in the department of physical geography, the application of their effects, as illustrations of changes on the earth's surface, belongs to geology.

bituminous substances, sometimes issue from the ground in great abundance; whilst thermal or hot springs often occur, possessing a very high temperature, and it not unfrequently happens that the temperature of springs is raised after earthquakes, even in districts distant from active volcanos. These volcanic regions, or bands, appear to have a general correspondence with the direction of the most elevated land in the districts they traverse. Thus, in Europe and Asia, the volcanic band runs parallel to the grand mountain ranges of those regions; and in America, it extends along the line of the mighty Andes. In more scattered volcanic groups, such as the Polynesian volcanic region, we usually find one island forming a central focus; of this the island of Hawaii forms an instance.

The principal volcanic regions, or bands, are those extending from the Caspian Sea to the Azores; from the Aleutian Isles to the Moluccas; and the volcanic region of the Andes. To these may be added, though of inferior importance, the African volcanic region, and the Icelandic volcanic region.

CHAPTER III.

GENERAL DISTRIBUTION OF LAND AND WATER.—MOUNTAINS, VALLEYS, PLAINS.—TABLE OF HEIGHTS OF MOUNTAINS, ETC.

So high as heaved the hills, so low
Down sank a hollow bottom, broad and deep,
Capacious bed of waters. MILTON.

ON referring to the map of the world, we cannot fail to be struck with the unequal distribution of land and water on its surface, and with the large proportion covered by the waters of the ocean. The whole superficies of the globe (speaking in round numbers) is equal to 197,000,000 square miles, nearly; of this, the land does not occupy much more than 52,000,000 square

Map

of the

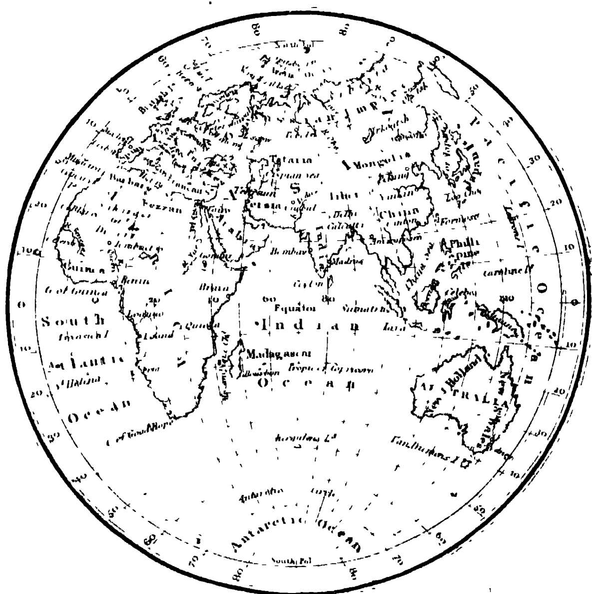
WESTERN HEMISPHERE

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Map

of the

EASTERN HEMISPHERE



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miles, or little above one-fourth part; whilst the ocean covers an area of more than 144,000,000 square miles. We shall further observe, that the proportion of dry land is much greater in the northern than in the southern hemisphere. The Antarctic regions are, however, too little known for any certain conclusion to be drawn respecting the relative proportions.

The sea occupies the cavities or depressions on the surface of the globe, separating and surrounding the more elevated portions of the earth's crust. The dry land may be arranged under two principal heads,—continents and islands. The term Continent has been applied to four portions of the earth, and it is common to speak of the continents of Europe, Asia, Africa, and America; but more correctly, there are only two continents,—two vast and detached portions of the globe,—the Old World and the New World; nay, in fact, these are but larger islands, though, on account of their vast extent, and the different natural phenomena presented by continental and insular surfaces, it will be highly desirable to distinguish these divisions of the earth by the designation of Continents.

The remaining portion of the dry land consists of islands of various dimensions, and of various elevation above the sea. Australia so greatly exceeds in size all other islands, that it has been ranked as a continent, but is, perhaps, with greater propriety included among the islands; it may, however, in conjunction with the numerous smaller islands with which the Pacific is studded, be regarded as a distinct division of the globe. This is sometimes distinguished by the appellation Oceanica.

The general disposition of the land will be observed to differ greatly in the Old and New Continents. In the Old World, especially in that portion which comprehends the divisions of Europe and Asia, the principal extension is from east to west; whilst in the New World, it is from north to south. In both cases, this extension is in the direction of the principal mountain ranges. Thus, in the Old Continent, a continuous, or nearly continuous line of mountain, extends from the borders of Europe, on the Atlantic, to those of Asia,

on the Pacific Ocean. In Africa the mountain ranges are less known. The Atlas range, which stretches in the same direction as the great European and Asiatic line, is considered to form a portion of that vast range. The greatest length, however, of Africa is from north to south; and although the interior of this portion of the globe is still too much involved in obscurity for any certain conclusions to be formed, yet, from the general direction of the rivers, and from the notices of travellers, there is much reason to infer, that a range of mountains more or less interrupted, extends from Abyssinia towards the southern extremity of Africa.

This general correspondence between the form of the land and the direction of mountain ranges, is more strikingly exemplified in America, where the Rocky Mountains, and the elevated districts of Mexico, in the northern, and the stupendous Andes in the southern, hemisphere, pursue, in a remarkable manner, the general direction of the New Continent. The same character is observable in smaller portions of land, and also in islands, the form of which usually coincides with that of their principal mountain ranges. This is well illustrated in the Dofraveldt Mountains in Scandinavia, in the Apennines in Italy, and in the islands of Japan, Sumatra, &c.

Whilst considering the general configuration of the land, we may further observe, that in those portions abutting on the great basin of the Atlantic, the proximate sides of the Old and New Continents appear as though they were, in some measure, mutually influenced by the forms of each other. Thus, the coast of Brazil, which forms the principal eastern projection of South America, is almost opposite to the vast African bight, or bay, which extends from Cape Palmas to Cape Negro; whilst the great western projection of Africa is counterbalanced by the basin of the Caribbean Sea and the Gulf of Mexico; and the south-western *trending*, or stretching out of the coasts of Europe, is answered by the receding of the opposite shores of North America.

The dry land is elevated into mountains and highlands, spread forth in plains, or depressed into valleys, all varying in

extent and in elevation above the level of the sea; with one exception, however,—a large area occurring in Central Asia, including the Caspian Sea and the Lake of Aral, which is below the level of the ocean*.

The immense basin, which is occupied by the waters of the ocean, is apparently diversified in its surface like the dry land, the submarine valleys forming the deep and fathomless abysses of the sea, whilst the summits of the mountains constitute islands; the shores of the latter being more or less abrupt, according to the character of the oceanic mountains rising above the surface of the waters.

We have already seen, that the direction of mountain ranges usually accords with that of the greatest extension of land, in all regions where they occur, whether of large or small dimensions; the length of mountain ranges is therefore generally very great in proportion to their width. They often consist of one grand central range, from which branches or ridges of inferior elevation diverge at right angles; whilst from the latter, smaller lateral branches or spurs again extend, forming hills; and these usually gradually diminish in height until they are lost in the plains. Mountain ranges of considerable elevation are also occasionally met with running parallel with each other, and inclosing between their ridges either elevated table-lands or deep valleys.

It rarely happens that both sides of mountain ranges present a similar character, one declivity being usually much steeper and more abrupt than the other, a circumstance which has considerable influence upon the temperature on the opposite sides of mountains. The declivities are generally steepest where great depressions occur, and accordingly, when mountains abut on the sea, we find their steepest slopes are most frequently presented to that side. Thus, the ridges of the Scandinavian mountains, and those of Greenland, both present their boldest escarpments to the North Atlantic Ocean. The lofty ridge of the Atlas gradually declines towards the Sahara,

* Recent investigations have shown that the level of the Caspian Sea is 101 feet lower than that of the Euxine, or Black Sea.

or Great Desert, but is very abrupt on the northern side, where

> Mauritania's giant shadows frown
> From mountain cliff to coast descending sombre down.

The mighty range of the Andes has generally a gradual slope on its eastern declivity, but presents a series of rugged precipices to the Pacific, in some parts strikingly bold and abrupt.

Isolated or detached mountains are usually of volcanic origin. In some instances these attain a great elevation, of which Etna, Ararat, the Peak of Teneriffe, and Mowna Roa, form examples; but the loftiest summits generally form parts of extensive mountain ranges; and a reference to the table at the end of this chapter will show that the most elevated mountains of Europe occur in the Alps, those of Asia in the Himalaya Mountains, and those of America in the Andes.

In describing mountain ranges, it is usual to adopt some terms which may be conveniently applied to distinguish the different portions of the system. The selection of these terms may be of little importance, but when our choice is made, it will be highly desirable to adhere to those we have chosen. A *tree* will perhaps be found not ill adapted for this purpose. The *stem*, or *axis* *, will form an apt representative of the grand central range of a mountain system; the lateral *branches* of the plant will correspond with the inferior ridges, or mountain *branches*, which diverge at right angles from the central line, and which, like the branches of a tree, usually diminish in size as they recede from the central stem, or axis; whilst the *spurs*, or *small branches*, will appropriately designate the small collateral *ridges* which diverge from the larger ridges.

Mountain ranges and hilly districts are intersected by *valleys*, the general arrangement of which corresponds with that of the mountainous or hilly ranges amongst which they are situated.

Valleys are distinguished according to their relative arrangement, into principal valleys, lateral valleys, and subordinate

* In botanical momenclature, the stem is called the *axis*, or centre, of a plant, because from thence the branches, leaves, &c., diverge in all directions.

valleys. *Principal valleys* are such as separate extensive parallel ranges of mountains; of this description is the Valais, or Valley of the Rhone. *Lateral valleys* are valleys which intersect, and are formed by the lateral branches of a mountain range; and *subordinate valleys* are such as are formed by the spurs or minor branches, and are usually of inferior size. When valleys are narrow and difficult of access, they are termed ravines, dells, defiles, or passes. These narrow valleys are of most frequent occurrence among steep mountains, where the sides rise with precipitous abruptness, and often present scenes of much beauty and grandeur.

Some valleys consist of a series or continuation of basin-shaped cavities, successively rising in elevation, and separated from each other by a rocky barrier. In valleys of this description distinct ridges, apparently formed by deposits from water, frequently occur, marking the height at which the waters formerly stood. These ridges may often be traced at parallel heights on both sides of the valley, and from the level road-like appearance they present, they have been termed *parallel roads*. They are of frequent occurrence in all mountainous districts, and are not uncommon in the Highlands of Scotland. Such are the parallel roads of Glen Roy, Glen Ghoy, and Glen Spean.

Some valleys are basin-shaped, or of a circular form, being surrounded on all sides by a girdle of mountains, with the exception of a narrow gorge, or outlet, through which the superabundant waters of the valley make their escape. Bohemia forms an example of such a valley, and consists of a single circular basin nearly 200 miles in diameter, and presenting the appearance of having been a vast lake, until a passage was forced through the Erzgebirge Mountain, and the gorge formed, through which the river Elbe at the present day flows into Saxony. Unless effected by slow degrees, and by the gradual wearing away of the mountain ridge, how fearful would be the devastating effects caused by the bursting of such a barrier, and the overflowing of such a lake!

Numerous instances also occur of mountain valleys still

forming the beds of lakes; in these cases the waters not having yet effected their escape. Lakes of this class are met with in the Alps, the Pyrenees, in the Himalaya Mountains, the Andes, &c., and, though on a very small scale, in our own island: the tarn, or little lake, on the summit of Cader Idris affording an example of such a mountain lake.

Plains of greater or less extent, presenting comparatively small inequalities, occur in all parts of the globe. A vast plain of this description occupies a considerable portion of Northern Europe, commencing on the German Ocean, and comprising the Netherlands, Denmark, the northern districts of France and Germany, a considerable portion of Poland, and nearly the whole of European Russia, and terminating only at the base of the Oural or Uralian Mountains. In the whole of this vast expanse the surface is in no part broken by hills of any elevation, except between Toropetz, Smolensk, and Moscow, where the low Valdai range (not exceeding 1200 feet in height) extends. This vast plain, or lowland, is separated by the Uralian range from another of yet greater extent, the Siberian lowland, which occupies nearly the whole of Northern Asia. Though many portions of these vast plains are covered with morasses, peat-bogs, and other tracts unfit for cultivation, much of the surface is fertile, yielding abundant crops of grain and other produce; and a considerable portion is occupied by forests of birch and pine. The depression before alluded to, in the region of the Caspian Sea, may be considered as a continuation of the great European lowland.

A vast plain, or lowland, extends across the northern part of Africa stretching from the shores of the Atlantic to the valley of the Nile, and being partially bounded on the north by the Atlas range, and terminated on the south by the elevated land which extends across from Cape Verde to Abyssinia. By far the greater portion of this tract, called the Sahra, or Great Desert, consists of an enormous zone of sand, having a length of 2470 miles, and a breadth of 900. This

Wild expanse of lifeless sand and sky

is in some parts broken by low hills of sandstone, or by tracts

of clay; and occasionally it is enlivened by verdant patches, called wadys or oases, appearing like islands in the desert, and varying in extent according to the supplies of water they obtain. The most considerable of these oases form the principalities of Fezzan and Darfûr; but the most celebrated, though less in extent, is that of Sivah, "the palms of which still wave over the ruins of the temple of Ammon, which indicate the ancient seat of African civilization."

In the New World, the great valley of the Mississippi presents a vast and magnificent plain. A large portion of this great lowland is remarkably level, and consequently subject to periodical inundations from the mighty rivers by which it is traversed. The more elevated parts consist of an alternation of forests and prairies, or extensive natural meadows, abounding in wild animals.

The lowlands of South America, called llanos, or pampas, and savannahs, are of equal extent. They are naturally divided into three basins, the most northerly being that of the Oronooko, situated between the ridge of Caraccas and the highlands of Guiana, and extending westward to the base of the mountains of New Granada. The second great lowland, or the basin of the Marañon or Amazons, occupies the space between the mountains of Guiana and those of Brazil, stretching nearly across the continent to the foot of the mighty Andes. To the level plains in this part the name of llanos is more especially applied; they are of immense extent, and are covered with luxuriant herbage, the consequence of the periodical inundations to which they are subject. The third lowland of South America forms the basin of Paraguay and La Plata. It includes the vast pampas, or unvaried plains of Buenos Ayres, which extend westward to the foot of the Andes, and southward to the cheerless wastes of Patagonia.

The plains to which we have hitherto directed our attention, are for the most part little elevated above the level of the sea, but there is another class of plains which claim some notice, and which are termed *plateaus*, or *table-lands*, an appellation which has been bestowed on account of their elevation above the other

plains, and occasional table-like form, rising abruptly, with steep acclivities on every side. The name is, however, equally applied to any plains of considerable elevation above the sea, and they are not unfrequently met with among extensive mountain ranges, supported and bordered by the highest portion of the range, which again towers pre-eminently above them. Some of these table-lands are of great extent, and retain a general elevation of several thousand feet above the sea, though in many instances their surfaces are much undulated.

The most considerable table-land in Europe is that of central Spain, embracing the two Castiles, which has a general elevation of 2000 feet above the level of the sea.

> Far as the eye discerns, withouten end
> Spain's realms appear, whereon her shepherds tend
> Flocks whose rich wealth right well the trader knows.

The descent from this table-land, or plateau, is on all sides very steep, and the transition from the almost treeless plains of Castile, to the milder climate and luxuriant vegetation of the lowland plains at the foot of the table-land, is very striking."

Asia perhaps presents some of the most extensive table-lands on the face of the globe. The most remarkable of these is the vast region of Central Asia, situated between the Altai Mountains and the Himalayah range, and which includes Tibet and the deserts of Cobi and Shamoo. This grand plateau is considered to have an elevation of from 9000 to 10,000 feet, or more, above the level of the sea. In Persia we also meet with a table-land of considerable extent, the general elevation of which appears to be about 4000 or 5000 feet above the sea. The Dukhun, or Deccan, in Southern India, affords another instance of a table-land; the general elevation of this region is not, however, so great, usually not exceeding 3000 feet.

A table-land of considerable extent has been observed in Southern Africa. It is situated between the Orange river and the Kuisip, which flows into Walvisch Bay, and is flanked by the Unuma or Bulb Mountains. Its general elevation is from 2500 to 3000 feet above the sea level.

The New World affords examples of some very consider-

able plateaus. That of Mexico has a general elevation of 7000 feet above the sea; but its surface is varied by hills, and there are even plains of some size which are more than 1000 feet above the general level of the plateau. Of this, the plain of Toluca forms an example.

Several less extensive but very elevated table-lands are included between the two lofty parallel ranges which constitute the Andes of Peru and Colombia. Such is the table-land of Quito, the general level of which is 8000 feet above the sea; and that of Riobamba, which is more than 10,000 feet above the level of the sea.

TABLE OF HEIGHTS OF MOUNTAINS, &c.

EUROPE.

	Feet.
Mont Blanc, Alps	15,781
Monte Rosa, ditto	15,585
Oertler Spitze, ditto	15,430
Mont Cervin, ditto	14,856
L'Alle Blanche, ditto	14,775
Louceira, ditto	14,451
Loucelon, ditto	14,144
Finster-aar-horn, ditto	14,116
Furca, ditto	14,104
Olan, ditto	13,838
Jung-frau, ditto	13,720
Grand Glockner, ditto	13,713
Pelvoux, ditto	13,442
Shreckhorn, ditto	13,397
Monte Viso, ditto	12,532
Malahaçen, Sierra Nevada, Spain	11,673
Mont Cenis, Alps	11,460
Maladetta, Pyrenees	11,436
Valeta, Sierra Nevada	11,398
Mont Perdu, Pyrenees	11,283
Great St. Bernard, Alps	11,006
Simplon, ditto	11,000
Etna (Monte Gibello), Sicily, volcano	10,963
Aiguille Noire, Alps	10,505
Little St. Bernard, ditto	9,594
Lomnitz, Carpathians	8,540
Orbelus, Greece	8,500
Velino, Naples	8,397
Schneehatten, Norway	8,115
Parnassus, Greece	7,900
Mont Pilate, Alps	7,000
Pindus, Albania	7,000
Monte Cimone, Apennines	6,971
Snæfell, Iceland	6,800
Mont d'Or, France	6,707
Olympus, Greece	6,500
Puy de Cantal, France	6,355
Dole, Jura	5,412
Schneekopf, Riesengebirge, Silesia	4,950
Hecla, Iceland, volcano	4,900
Brocken, Hartz, Hanover	3,690
Vesuvius, Italy, volcano	3,400
Stromboli, volcano	3,000
Gibraltar, Andalusia	1,439
Valdai Hills, Novgorod, Russia	1,200
Montmartre, Department of La Seine	400

BRITISH ISLANDS.

Ben Macdui, Aberdeenshire	4,418
Ben Nevis, Inverness-shire	4,358
Cairngorm, ditto	4,050
Ben Lawers, Perthshire	3,944
Ben More, Sutherlandshire	3,908
Ben More, Perthshire	3,818
Ben Gloe, ditto	3,724
Ben Wyvis, Ross-shire	3,720
Ben Ledi, Perthshire	3,651
Schehallien, ditto	3,613
Snowdon, Caernarvonshire	3,571
Macgillicuddy's Reeks, Co. Kerry	3,410
Ben Lomond, Stirlingshire	3,191
Sleibh Dorin, Derry	3,150

	Feet.
Helvelyn, Cumberland	3,055
Skiddaw, ditto	3,022
Ben Venue, Perthshire	3,000
Goat Fell, Isle of Arran	2,945
Cader Idris, Merionethshire	2,914
Cheviot, Northumberland	2,658
Plinlimmon, Cardiganshire	2,463
Ingleborough, Yorkshire	2,361
Snaefell, Isle of Man	2,004
Holmemoss, Derbyshire	1,859
Brown Clee-hill, Shropshire	1,805
Dundry Hill, Somersetshire	1,668
Malvern Hills, Worcestershire	1,414
Wrekin, Shropshire	1,320
Arthur's Seat, Mid Lothian	810
Dunnose, Isle of Wight	810
Beechy Head, Sussex	564

ASIA.

Dhawala-giri, Himalaya	23,862
Jewahir, ditto	25,749
Jamautri, ditto	25,500
Chamalari, ditto	25,000
Purgkeeool, Chinese Tartary, twin peaks	22,488
Raaldung, Himalaya	21,103
Hindoo Koosh	20,500
Elburz, Caucasus	17,796
Ararat, or Agri-dagh, Armenia,	17,266
Klutchefskaia, Kamtchatka, volcano	15,825
Kazbec, Chinese Tartary	15,345
Petchan, ditto, volcano	15,000
Demavend, Elburz range, Mazanderan	14,700
Ophir, Sumatra	13,842
Argæus, or Arjish-dagh, Asia Minor	13,100
Sevellan, Azerbijan	13,000
Sochonda, Chinese Tartary	12,800
Gunong Dempu, Sumatra, vol.	12,465
Koriatskaia, Kamtchatka, do.	11,215
Bieluka, Altai	11,000
Supan-dagh, Armenia	11,000
Italitskoi, Altai	10,735
Krionotskaia, Kamtchatka, volcano	10,625
Shivelulsh, ditto, ditto	10,591
Awatska, ditto, ditto	9,600
Lebanon, Syria	9,520
Dodabetta, Neilgherries, India	8,760
Mo-lin, China	8,200
Sinai, Arabia Petrea	7,500
Olympus, Asia Minor	6,500
Bettigo, Western Ghats, India	6,500
Casius, Syria	5,318
Papandayang, Java, volcano	5,000
Ida, Asia Minor	4,960
Plain of Ispahan, Irak, Persia	4,140
Chaingour, Vindhya Mtns.	2,400
Carmel, Palestine	2,160
Tabor, ditto	1,950

AFRICA.

Geesh, Abyssinia	15,000
Amid, ditto	13,000
Camaroons, Biafra	13,000
Peak, Teneriffe, volcano	12,236
Lamalmon, Samen Mountains, Abyssinia	11,400
Miltzin, Atlas	11,200
Clarence Peak, Island of Fernando Po	10,655
Nieuveldt, Beaufort, Cape of Good Hope	10,000
Compass-berg, Graffreynet, ditto	10,000
Gros Morne, Isle de Bourbon	9,600
Peak, Fuego or Fogo, Cape Verde Islands, volcano	7,884
Volcano, Isle de Bourbon	7,681
Trigo, Canaries	7,400
Peak, Azores	6,900
Peak, Tristan d'Acunha	6,400
Khamies, Cape of Good Hope	5,300
Riuvo, Madeira	5,162
Table Mountain, Cape of Good Hope	3,582
Green Mountain, Isle of Ascension	2,868
Diana's Peak, St. Helena	2,692
Lion's Head, Cape of Good Hope	2,166
Cape of Good Hope	1,000

AMERICA.

Nevada de Sorato, Andes	25,250
Illimani, ditto, first peak	24,450
Ditto ditto, second peak	24,200
Gualatieri, Andes, volcano	22,000
Chimborazo, ditto	21,440
Cayambe, ditto, volcano	19,625
Antisana, ditto, ditto	19,150
Cotopaxi, ditto, ditto	18,858
Arequipa, ditto, ditto	18,373
Pic de Tolima, ditto	18,314
Popocatepetl, Mexico, volcano	17,716
Illiniza, Andes	17,376
Orizaba, Mexico, volcano	17,371
Tungurагua, Andes, volcano	16,579

	Feet.
Nevada de Merida, Colombia	16,420
Cerro de Potosi, Andes	16,000
Mount Hood, North America	16,000
Pichincha, Andes, volcano	15,940
Mount Brown, Rocky Mounts.	15,900
Nevada de Mexico	15,700
Long's Peak, or Bighorn, Rocky Mountains	15,000
Mount Elias, North America, volcano	15,000
Mount Fairweather, ditto	14,000
Mount St. Helens, ditto	14,000
Coffre de Perote, Mexico	13,514
Water Volcano, Central Ameri.	12,600
James's Peak, Rocky Mtns.	12,000
Sierra de Combre, Cuba	9,000
Serrania Grande, Hayti	9,000
Silla de Caraccas, Colombia	8,630
Duida, ditto, volcano	8,467
Blue Mountains, Jamaica	7,486
Mount Washington, White Mountains, U. S.	6,650
Morne Garou, St. Vincent's, volcano	5,110
Souffrière, Guadaloupe, ditto	5,040
Jorullo, Mexico	4,267
Kaatskill, New York	3,454
Apalachian Peak, U. S.	2,700
Cape Horn, Tierra del Fuego	1,870
OCEANICA.	
Mowna Koah, Hawaii	18,400
Mowna Roa, ditto, volcano	16,020
Peak, Balleny Isles, S. Sea	12,000
Egmont, New Zealand, vol.	11,433
Peak, Tahiti	10,895
Sea View Hill, Australia	6,500
Mount William, ditto	4,500
Ben Lomond, Tasmania, (Van Diemen's Land)	4,200
Kiraueh, Hawaii, volcano	3,873

	Feet
Mount Wellington, Tasmania	3,795
Forest Hill, Australia	3,776
Mount York, ditto	3,292
Mount Exmouth, ditto	3,000
Bathurst Height, ditto	2,000
Manasarooa (Manasarowara) Lake, Tibet	14,500
Lake of Puno or Titicaca	12,795
Lake Luçon, Switzerland	6,220
Lake of Lucerne, ditto	1,380
Lake of Geneva, ditto	1,207
Lake Superior, North America	641
Lake Erie, ditto	560
Lake Ontario, ditto	230
Village of Daba, Tibet	14,500
Shepherds' Huts on Antisana, Andes	13,435
Town of Potosi, South America	13,350
Milum Temple, near the source of the Ganges	13,000
City of Riobamba, South America	10,800
City of Quito, ditto	9,356
City of Toluca, Mexico	8,818
Hospice of St. Bernard, Alps	8,6[illegible]
City of Mexico	7,470
Hospice of St. Gothard, Alps	6,900
St. Veran, Cottian Alps, the most elevated village in Europe	6,693
City of Madrid	2,173
Leadhills House, Lanarkshire, the highest inhabited spot in Britain	1,280
Great Pyramid of Egypt	720
Dover Castle, Kent	469
City of Edinburgh	443
City of London (St. Paul's Cathedral)	400
Greenwich Observatory, Kent	214

Highest ascent in a balloon (MM. Biot and Gay Lussac, at Paris, in 1804) 22,900

Elevation attained by MM. de Humboldt and Bonpland, on Chimborazo, in 1803 19,332

Elevation attained by M. Boussingault and Col. Hall, on Chimborazo, in 1831, the greatest terrestrial height hitherto accomplished 19,699

Highest flight of the Condor 21,000

CHAPTER IV.

DISTRIBUTION OF THE WATERS OF THE GLOBE.—OCEAN.—INLAND SEAS.—LAKES.—RIVERS.—SPRINGS.

Turn to the watery world —CRABBE.

ALTHOUGH, for the convenience of description, the ocean has received several nominal subdivisions, yet, correctly speaking, the different seas and oceans are but parts of one mighty whole, one "capacious bed of waters."

O, thou vast ocean! ever sounding sea!
Thou symbol of a dread immensity!
Thy voice is like the thunder; and thy sleep
Is as a giant's; slumber loud and deep,—
Thou speakest in the east and west
At once.

The two principal divisions of the ocean, the Atlantic and the Pacific, are formed by the extension from north to south of the two great continents. The Austral, or Southern Ocean, may be considered as forming a third division, and occupies that portion of the ocean not included in the two former. Its limits may be marked by a line passing round the globe, and touching the Cape of Good Hope, Cape Horn, and the southern extremity of Tasmania, or Van Dieman's Land.

The Atlantic Ocean is sometimes subdivided into three portions—the Northern Ocean, the North Atlantic, and the South Atlantic. The imaginary separation between the Northern Ocean and the North Atlantic, is marked by a line drawn across the ocean, from the southern extremity of the British Isles to the southern extremity of Greenland. The North Atlantic extends from thence to the equator; and the South Atlantic from the equator to the southern extremities of Africa and America.

The Pacific Ocean has also three nominal subdivisions,—the North and South Pacific, and the Indian Ocean. The North Pacific extends from Behring's Straits to the equator, and the South Pacific from thence to Cape Horn and the southern side

of Australia. The Indian Ocean comprehends the seas between Australia and the Malayan Islands, and the eastern coast of Africa. Its separation from the Austral, or Southern Ocean, is merely nominal.

With these oceans, various seas communicate, either by narrow straits, as the Mediterranean, the Red Sea, and the Baltic; or by wider channels, as the White Sea, the Yellow Sea, Baffin's Bay, &c.

Besides these seas, all of which have an outlet into the main ocean, and most of which penetrate to a considerable extent into the land, we meet with other seas which are wholly inland. Such are the Sea of Aral, and the Caspian Sea. These, however, though denominated seas, have many of the characteristics of lakes; and perhaps it would not be easy to define the difference between an inland sea and a lake. If size be considered to form the distinction, the lakes of North America will doubtless be entitled to rank as seas; if saltness, the lakes of Van, in Armenia, and of Ourmia, in Persia, with many others of smaller size, are entitled to this distinction.

The most celebrated European lakes are those of Constance and Geneva. The Russian lakes, of which Ladoga is the largest, are, however, of much greater extent. The British lakes, though presenting much picturesque scenery, are of small size; the largest English lakes, those of Westmoreland and Cumberland, would appear as mere specks on a map of Europe. The lakes of Scotland, of which Loch Lomond is the largest, though of somewhat greater extent, are insignificant in a general view of the world. The lakes of Ireland are likewise of small dimensions; but the Lake of Killarney and Lough Erne are celebrated for their beautiful and picturesque scenery.

Asia contains some fresh-water lakes, among which is that of Baikal, but the greater number of its lakes are salt. The most celebrated of the latter is Lake Asphaltites, or the Dead Sea, which is more saline than the ocean. Many of these natural depositories of salt are situated in the interior of this vast region, and their occurrence in districts so far removed from the sea, is of great importance to the inhabitants, who in

many cases, obtain considerable supplies of that valuable article, merely by collecting the saline incrustations formed round the margin of the lakes.

We are too little acquainted with the interior of Africa, to speak with any certainty as to the number or character of its lakes; but the Lake Tchad is described as one of the largest fresh-water lakes in the world.

North America, however, may be considered as the country of lakes. A vast chain more or less connected with each other, extends across a large portion of the continent, commencing near the shores of the Arctic Ocean, and terminating on those of the Atlantic. Many of these lakes are of great extent, but the most remarkable are those which form the great water system of Canada. The largest of these is Lake Superior, which has an extreme length of 380 miles, and a breadth of 161 miles. The surface occupied by the lakes Superior, Michigan, and Huron, is computed at 72,930 square miles.

South America is very deficient in lakes; that of Titicaca, being the only considerable one in this portion of the New World. This lake, however, is remarkable on account of its great elevation above the level of the sea.

The size and course of *rivers* is mainly determined by the height and direction of the mountain ranges, or hilly districts, in which they take their rise; and also by the extent of surface between their sources and the sea. A reference to Plate III. will show that the longest known rivers in the world are those of North and South America.

The largest rivers of Europe, the Rhine, the Rhone, and the Danube, take their rise in the Alps. When mountain ranges form the separation between two countries, the boundary is not unfrequently marked by the course the rivers take, which is called the *water-shed.* Thus, in the Pyrenees, the direction of the streams flowing either north or south, marks the limits of the two kingdoms of France and Spain.

The majestic rivers of Asia, the Ganges, the Indus or Scind, the Irawaddy, and the Brahmapootra, have their sources in the Himalayan range. The rivers of China, also, take their rise in

the continuation of the same vast line of mountains. The northern rivers of Asia, the Irtish, the Obi, and the Yenesei, all originate in the Altai mountains.

In Africa, the Nile has one of its sources among the lofty mountains of Abyssinia, and the other in the more distant central range. Respecting the sources of the other principal rivers of Africa, there is still much obscurity.

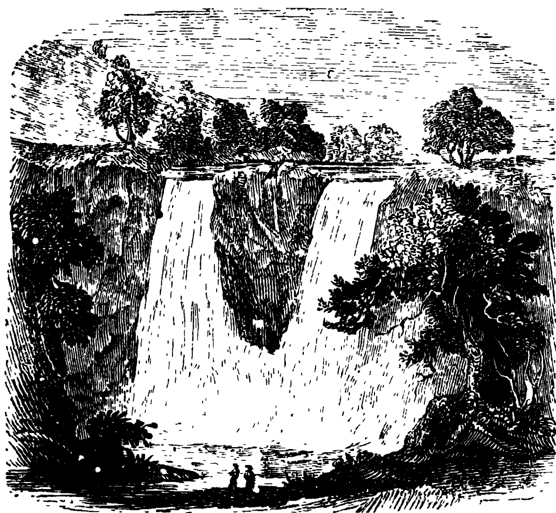
In North America, the Arkansas, the Red River, and the Missouri, all tributaries of the Mississippi, take their rise in the Rocky Mountains. In the same great range, we also, meet in close connexion, the sources of the river Colombia, and of the Saskatchewan; the former of which, taking a westerly course, falls into the Pacific; whilst the latter, flowing in an opposite or easterly direction, enters Lake Winnepeg, and passing through the vast chain of lakes, of which the St. Lawrence forms the outlet, finally falls into the Atlantic Ocean.

In South America, the majestic Maranon, or river of the Amazons, the Oronooko, the Magdalena, and other vast rivers. spring from the mighty range of the Andes. The Parana and the Paraguay take their rise in a range of less elevation, which stretches across the continent to the coast of Brazil.

When the sources of rivers lie among mountains, they are subject to sudden descents, which give rise to rapids, cascades, and cataracts. Rapids are caused by the greater slope or inclination of the bed of the river, which causes the water to rush down in that particular part, sometimes with fearful velocity. Cascades and cataracts are formed by the water precipitating itself from a ledge or mass of rock, with a perpendicular, or nearly perpendicular descent. When in their most impetuous character, they are denominated cataracts; when more gentle, they are termed cascades.

Although England may not boast of any waterfalls that can vie with those of countries of more mountainous character, it nevertheless possesses some cascades of considerable beauty. Cumberland, Westmoreland, Durham, Yorkshire, and Devonshire, present many instances of picturesque waterfalls. One

of the most beautiful in this country is the fall of the Tees, in Durham.



Fall of the Tees.

The river, obstructed and divided by a mass of rock, descends in a double cataract from the top; but reuniting its waters before they reach the bottom, the whole dashes into the basin with a force and grandeur scarcely inferior to the cataracts of Switzerland, or even America.

The falls of the Cayne and the Mawddach, in Merionethshire, called Pistil-y-Cayne and Pistil-y-Mawddach, are highly picturesque. The former is described as particularly magnificent. Scotland presents us with some very grand waterfalls. The most stupendous is that of Glomach, in the county of Ross. In Ireland we meet with the fall of Powerscourt, in the county of Wicklow, which is remarkable for the beauty of the surrounding scenery.

Amongst the most celebrated waterfalls of Europe are the cataracts of the Dahl, in Sweden; of the Rhine, near Schaff-

hausen; of the Staubbach, in Switzerland; of Tivoli, an Terni, in Italy; and of Ceresoli, in Savoy. The latter is said to have a fall, not unbroken, however, of 2400 feet.

The most remarkable known waterfalls of Asia are situated among the Himalayan mountains. A cataract of the Shirawati, in the Indian province of Canara, is described as being of surpassing beauty and sublimity, and as having a fall of 1150 feet.

We have remarked that North America has been called the country of lakes; it may certainly with equal propriety be termed the region of waterfalls. Besides a very large number of rapids and minor falls, it contains an unusual number of principal cataracts. This is in great measure owing to the geological character of the country, to which we shall, in a future page, direct our attention. These falls are, however, generally more remarkable for the vast body of water they pour down, than for the depth of the falls. The stupendous Fall of Niagara is formed by a large and rapid river, 1650 feet in width, which precipitates itself by two channels in one leap, 160 feet perpendicular.

Smooth to the shelving brink a copious flood
Rolls fair and placid, where collected all
In an impetuous torrent, down the steep
It thundering shoots, and shakes the country round;
At first an azure sheet, it rushes broad,
Then whitening by degrees, as prone it falls,
And from the long-resounding rocks below
Dashed in a cloud of foam, it sends aloft
A hoary mist, and forms a ceaseless shower.

South America contains several waterfalls; the most celebrated of these is the cataract of Tequendama, near Bogota, situated amongst some of the most picturesque scenery of the Andes, and which has a fall of 540 feet.

Rivers are fed either by springs or by the melting of the snows. They do not, therefore, receive their largest supplies from the actual summits of mountains, for large springs are not of ordinary occurrence near the summits of the mountains; nor are the vast accumulations of ice and snow, called glaciers, met

with on the highest points, or peaks of mountains, but usually on the declivities, or slopes of the upper mountain valleys.

Springs derive their supplies from water, raised into the atmosphere by evaporation, and again deposited on the earth in the form of showers, or mist. This moisture, entering the ground by means of fissures in rocks, or through porous beds, continues to sink, until arrested in its progress by rocks impermeable to water, when it gushes forth as a spring, larger or smaller, according to the supplies it has received. Mountains and hills arrest and condense clouds, and consequently a greater deposition of moisture takes place in mountainous districts; but it will be evident that a peak, or pointed summit, on account of the small surface it presents for collecting the waters from above, will not be favourable to the formation of copious springs.

The largest spring in Great Britain is that of St. Winifred's Well, at Holywell, which is said to throw up about twenty-one tuns of water per minute, or 30,240 tuns daily.

All springs contain some solid matter, either saline or mineral; when this is in excess, they are termed mineral springs. Such are the waters of Tunbridge, Cheltenham, and Harrowgate.

Thermal, or hot springs, occur in almost every region of the globe. Some are of very high temperature; the hottest in this country are those of Bath, which have a temperature of 116°. The Carlsbad springs, in Bohemia, have a temperature of 167°; and those of Coquinas, in Sardinia, a temperature of 198°. The boiling springs of Iceland are well known: and the magnificent jets or fountains of boiling water periodically thrown up by the Geysers, entitle them to be ranked among some of the most extraordinary phenomena of the natural world. The Great Geyser shoots up vast columns of boiling water to the height of ninety or one hundred feet, which succeed each other with great rapidity, after which a pause ensues. There are generally four great series of such eruptions in the course of twenty-four hours, but the intermissions of this extraordinary fountain are not absolutely regular.

CHAPTER V.

THE ATMOSPHERE; ITS CONSTITUTION, AND WEIGHT OR DENSITY.—EVAPORATION.—DEW.—MISTS.—CLOUDS.—RAIN.—WINDS.

. . . . God made
The firmament, expanse of liquid pure,
Transparent, elemental air, diffused
In circuit to the uttermost extent
Of this great round. MILTON.

THE earth is surrounded by an invisible, and highly elastic fluid, termed its *atmosphere*, which may be considered as a body, accompanying and revolving with the earth. The extent of the atmosphere is supposed to be about forty or fifty miles.

Atmospheric air was long considered to be an "elemental" or simple body, but it is now well known to consist of a mixture of oxygen and nitrogen gases, in regular proportions, usually estimated at twenty-one parts of oxygen to seventy-nine of nitrogen. The atmosphere also always contains a small proportion of carbonic acid, the quantity of which is subject to slight variations. It likewise holds water suspended, in the state of vapour, the proportions of which are still more fluctuating.

Air is ponderable, or has weight; its weight, however, differs according to its temperature. At the temperature of 60° Fahrenheit, 100 cubic inches of air weigh 30½ grains troy; and a perpendicular column of the whole atmosphere weighs about 14½ pounds. This is just balanced by a mercurial column of about 30 inches in height; and it is on this principle that the mercurial barometer is constructed.

The weight or density of atmospheric air is not uniform throughout its whole extent; a gradual diminution taking place as we ascend above the level of the sea. The rate of decreasing density is such, that at the height of seven miles, the atmosphere would have a density equal to only one-fourth of that at the surface of the sea; and at the height of fourteen miles, it would have only one-sixteenth, and so on. These heights have never

been attained by man, but the ratio is the same at smaller elevations, and the consequence is, that on ascending elevated ground, the atmosphere exerts less pressure on any substance on which it rests.

The average pressure of the atmosphere (though subject to temporary alterations from meteorological causes,) is found to be the same, or very nearly so, at any one place from year to year; and over the whole globe its lines of equal density, or pressure, are parallel to the sea level. If, therefore, we know the mean density at any one station, for instance, 2000 feet above the sea, we may conclude that any other place, having the same density, has a similar elevation above the sea. This decreasing density is indicated by the barometer, the mercury in the tube falling at greater elevations. Thus, at the level of the sea, near the foot of Chimborazo, M. de Humboldt found that the barometer stood at exactly thirty inches; whilst at the elevation of 19,332 feet, to which he ascended on that mountain, it was no higher than fourteen inches and eight lines. And in December 1831, when M. Boussingault, accompanied by Colonel Hall, ascended the same mountain, to the elevation of 19,699 feet (the greatest terrestrial height yet accomplished), the barometer fell to thirteen inches, eight lines. At all other places having the same elevation above the sea (allowing for some variation of temperature), the indication of the barometer would be similar; and thus, by the use of that instrument, we are enabled to obtain a very near approximation to the heights of all places which are accessible to the foot of man.

The mean height of the barometer in London is twenty-nine inches and nine lines, nearly. The height of the mercurial column varies in this climate, from about twenty-eight to thirty-one inches.

Another mode of measuring heights, dependent also on the density or pressure of the atmosphere, is by the *boiling point of water*. In London, and at all other places having a similar elevation, water boils at 212° Fahrenheit; and we are so accustomed to associate the notion of its ebullition or boiling up, with that particular temperature, that perhaps at first we may

find some difficulty in reconciling the idea of "boiling water" with any other degree of heat. This ebullition, or boiling up of water is, however, dependent on the pressure of the air above it; and the boiling point of water decreases in a ratio nearly equivalent to the decrease of atmospheric density. And accordingly, at considerable elevations above the sea level, water, when boiled, does not acquire so high a temperature as 212°, and, under ordinary circumstances, cannot be raised to that temperature. At great elevations, it is, therefore, not so available for some culinary purposes; and, we much doubt (allowing all other conditions to be similar) whether so good a cup of tea could be made at the Hospice de St. Bernard, which is 8,600 feet above the level of the sea, as in the metropolis of England, at the former place the temperature of boiling water being only 203°: and still less could this be accomplished at the Cerro de Pasco, in Bolivia, (celebrated for its silver mines,) the height of which is 13,673 feet above the sea, and where the boiling point does not exceed 189°. The boiling point of water forms, however, a highly useful standard for measuring the altitude of any accessible locality.

Although a certain proportion of water or aqueous vapour is always present in the atmosphere, the quantity is liable to great variations, this being in great measure dependent on the temperature of the air. If water be exposed to the air, it gradually disappears, finding its way into the atmosphere by the process called evaporation. Warm air, however, is capable of taking up, and holding in suspension in the state of invisible vapour, more water than cold air. Thus, a cubic foot of air, at the temperature of 32°, the freezing point, has not capacity for holding more than two grains and about a third; whilst, at the temperature of 60° it will hold about five grains and three quarters; and at that of 70° nearly eight grains. This, it will readily be perceived, accounts for the greater rapidity with which a lake, or pond, or any other surface of water is dried up, or carried off in the form of invisible vapour, in warm than in cold weather. This, also, in great measure, accounts for the phenomena attending the formation of dew.

One of the conditions essential to the deposition of *dew*, is, that the atmosphere must contain an excess of moisture; that is, more than it has capacity to hold. When the air becomes heated during the day, and raised to a high temperature, its capacity for holding moisture is increased, and, under ordinary circumstances, by the means of evaporation, it will become charged with moisture. If, then, it hold in suspension aqueous vapour proportioned to its capacity, it will, when the temperature decreases towards night, contain an excess of moisture, or more than it has capacity for holding suspended at that lower temperature; and the superabundant moisture will accordingly, as the temperature of the air gradually diminishes, be gradually and gently deposited in the form of dew. The deposition will be greatest when a clear cool evening succeeds a sultry day. In our climate, the difference of temperature between day and night is usually greatest in spring and autumn; and consequently, the dews are generally most abundant at those seasons.

In calm weather, and under ordinary circumstances, the moisture evaporated from a given tract of land might be supposed to be deposited on the same tract at night. But even with a gentle breeze, this portion of air may be removed to a considerable distance before night-fall. If, however, the wind should pass over a similarly-constituted district, it may carry with it a similar supply of moisture; but should it cross an arid sandy tract, the air will not be replete with aqueous vapour and little or no deposition of dew will take place. If, on the other hand, the wind should pass over water, or a swampy surface, the deposition of dew may be increased. The difference in the quantity of dew deposited, according to local variations of the surface, is displayed to a certain extent in our own island. It may be familiar to our readers that dews are usually less copious during the prevalence of easterly than of westerly winds; a circumstance attributable to the different nature of the surface over which these winds pass: the easterly crossing the continent of Europe, whilst the westerly sweep across the wide Atlantic Ocean. This phenomenon is, however, more

strikingly exhibited in hot climates, where winds which pass over an expanse of water, usually become loaded with moisture, and a very copious deposition of dew takes place. Thus, in Egypt, the north wind, which crosses the Mediterranean, deposits dew in such abundance, that it is sufficient to soak through the garments of the inhabitants; whilst, during the prevalence of the south wind, which traverses extensive tracts of sandy deserts, no dew is deposited.

A serene and cloudless sky is very favourable to the deposition of dew, little or no dew being formed if the sky be veiled in clouds; a circumstance which has probably not escaped the notice of our readers, and which is, in some measure, attributable to the comparatively higher temperature, which usually prevails at nights, when the sky is clouded, than when it is clear; and it not unfrequently happens, that on nights when the sky is alternately clear and enveloped in clouds, dew will appear and disappear with the changing atmosphere.

It is also essential for the copious deposition of dew, that the ground, or any surface on which it forms, should possess a temperature considerably below that of the atmosphere. The air in contact with the cold body becomes chilled, and thus losing its capacity or power of holding so much invisible vapour the latter is condensed, and deposited in the form of dew. This effect may be observed when a glass of cold water is taken into a warm room in summer. The invisible vapour contained in the air of the apartment is condensed, and fixed on the exterior of the glass. It is also exemplified by the steam, as it is commonly called, or dew, frequently observable on the glass windows of an apartment. When the external air is considerably colder than that of the room, the glass acquires a corresponding low temperature, and the invisible vapour in the air of the apartment becomes condensed on the panes. The deposition will, of course, be greater or less, according to the heat and moisture of the apartment, and the cold of the external air; and if our apartments are kept warm, it is therefore generally more abundant in winter than in summer; and very copious deposits will be observed on the lights of hot-houses and conservatories.

For the rapid formation of dew, it is essential that the surface of a body should be ten or fifteen degrees cooler than the air. All substances are not, however, equally subject to be covered with dew; and the consequences to which this leads in the natural world, are of the most interesting character. In clear weather, a thermometer laid on grass, has been known to mark twelve degrees lower than one laid on garden-mould, and sixteen and a-half degrees lower than one laid on a gravel-walk. It will be evident, that a much more abundant deposition of dew will take place on the grass, than on the other portions of the surface: and thus we find, that the dew is most copiously deposited on the herbs of the field, which need this nourishment; whilst land, uncovered by vegetation, and more especially stony ground, which does not require and would not benefit by it, receives a comparatively small supply. Such is the enonomy of nature, and thus admirably has its All-wise Author adapted these, as well as numberless other means, so as to effect the utmost possible benefit to His creatures; often, however, performing their part so silently, and almost imperceptibly, that the closest investigation is required to discern their beauty and excellence.

> . . . . But what is all creation less
> Than a capacious reservoir of means
> Formed for His use, and ready at His will?

Mists, or *fogs*, are formed by the condensation of invisible vapour into minute drops of water, near the surface of the earth, and may be considered as dew, which, owing to incidental causes, remains suspended above the land or water, instead of descending in the form of dew. Mists, or fogs, are liable to be formed under circumstances unfavourable to the deposition of dew; namely, when the lower stratum of the air is cooler than the surface of the ground or water over which they rest. They are, therefore, more frequent in autumn, and at the approach of cold weather, than in spring; and as the temperature of the sea is often higher than that of the atmosphere, they are by no means uncommon on the ocean, more particularly in cold climates, and are very frequent in the polar

regions. A remarkable stationary fog occurs off the coast of Newfoundland, which owes its origin to the chilly atmosphere of that station, and the comparative warmth of the waters of the adjacent ocean, the temperature of which appears to be raised and maintained by the remarkable current called the Gulf Stream.

The formation of *clouds* is also effected by the condensation of vapour. Vapour is always invisible; clouds therefore are not vapour, but water. When vapour is cooled below its constituent temperature, it becomes visible, forming itself into a fine watery powder, the size of the particles of which it is composed being extremely minute. These particles, estimated by some authors as being one twenty-thousandth of an inch in diameter, and by others as not exceeding one hundred-thousandth of an inch, would descend very slowly, and clouds formed of an accumulation of these minute particles, would be readily carried by the wind. When, however, they unite into drops, they become heavier, and fall to the earth in the form of rain; the size of rain drops being considered to vary from one twenty-fifth of an inch to one-third of an inch. When drops are formed at a considerable height in the atmosphere, or in very cold strata of air, they descend in the form of hail or snow. If the congelation of moisture takes place slowly, snow is formed; whilst hail appears to be produced suddenly, by intense cold in the upper regions of the atmosphere; the latter, therefore, frequently occurs in summer, and in hot climates where snow is unknown.

The quantity of rain which falls in different parts of the earth is very variable; it, however, appears, that the mean annual quantity is greatest in tropical climates, and diminishes as we recede from the equator. Thus, the mean annual rain at

			INCHES.
Island of Granada,	lat. 12°,	is equal to	126
Calcutta . . .	lat. 22° 23′	„	81
Rome	lat. 41° 54′	„	39
Edinburgh . .	lat. 55° 57′	„	24
Petersburgh . .	lat. 59° 56′	„	16

But although this gradual diminution may be considered as a

general rule, the quantity of rain is by no means solely dependent on latitude, but is liable to vary according to local variations of the surface, being much influenced by elevated land, and also by trees, both of which attract moisture; and consequently elevated and well wooded districts are subject to more rain than flat or barren countries. Much also depends on the prevailing winds; if these pass over the ocean, they bring a considerable portion of vapour, and if the shores present an elevated surface, or are covered with forests, the vapour becomes condensed, and the moisture is deposited in the form of rain. In such cases, it not unfrequently happens that the air loses so much of its moisture, that a considerable difference occurs between the quantity of rain near the coast and further inland. In Great Britain, the winds sweeping over the expanse of the Atlantic Ocean, deposit more rain in the western, than in the eastern districts. Thus, as we have seen, the mean annual quantity of rain at Edinburgh is 24 inches, whilst in the neighbourhood of Glasgow it is 32 inches, and in some parts of Ayrshire, amounts to 52 inches. A very striking instance of the arresting and condensing effects of trees and elevated land is met with in Patagonia. On the western side of the Patagonian Andes, only a narrow slip of land, in most parts covered with the richest vegetation, lies between those mountains and the Pacific; the westerly winds, sweeping across the Pacific Ocean, arrived charged with vapour, which, owing to the wooded and hilly character of the district, becomes immediately condensed and deposited, in the form of abundant and almost incessant rain. The cold of the mountain ridge which separates this district from the plains of Eastern Patagonia, again still further arrests and condenses the vapour contained in the atmosphere, causing the whole superabundant moisture to be deposited on the summit; and thus, when the westerly winds prevail, no rain whatever falls on the eastern side of the mountain ridge, and the Patagonian plains being in consequence nearly destitute of moisture, present a singularly dreary and desolate aspect. In the northern parts of Chili and in Peru, on the other hand, the country between the Andes and the Pacific being flat and nearly

destitute of trees, the moisture brought by the westerly winds, is not attracted or condensed until it reaches the mountain ridge, the result of which is, that although an abundant deposition takes place on the mountains, giving rise to the most magnificent river system in the world, rain is unknown in Perú.

The general dampness of any climate does not, however, necessarily depend on the mean quantity of rain which falls in the course of the year, for a country may be involved in almost perpetual mists or drizzling rains, although the number of inches of rain during that period may not be great; and, indeed, generally speaking, the number of rainy days is least, where the annual fall of rain is greatest, the rains occurring periodically in extreme abundance, six inches, or more, sometimes falling in twelve hours. In some parts of the earth, however, extensive tracts exist, where rain is never known to fall, or if at all, only at intervals of many years, and then usually in small quantities. Such is the case with some parts of Arabia, with Egypt, and with the Sahrà; and countries so circumstanced, unless like Egpyt, fertilized by the overflowings of a great river, constitute the most arid and desert regions of the earth.

Countries situated within ten degrees of the equator, have commonly two rainy and two dry seasons; but beyond that degree of latitude, intertropical regions have only one rainy and one dry season, the rainy season usually lasting from four to six months, and occurring with great regularity. Beyond the tropics we also find some countries possessing rainy and dry seasons, occurring with considerable regularity; though others are subject to the variable rains which, to the north of the 45th parallel of latitude, generally prevail, and of which our own island proves a striking example.

The aerial currents called *winds*, appear to be caused by partial changes in the density of the atmosphere, arising principally from the unequal distribution of heat over the surface of the globe. In Great Britain they are exceedingly changeable, but in some parts of the globe they blow with almost unvaried regularity, and in others are subject to periodical changes.

The most remarkable winds are those denominated the *trade-winds*. In the whole band lying within the tropics, both in the Atlantic and Pacific Oceans, the wind has throughout the year, a general direction from the *east*. The cause of this perpetual current of air has been thus explained:—the heat between the tropics being greater than on the other parts of the earth's surface, and the incumbent air becoming warmer and consequently less dense, it accordingly rises from the surface, when the vacant place is immediately occupied by colder and therefore heavier air, which glides in on both sides from the regions beyond the tropics; but the air, when apparently at rest, is in fact only relatively so, because it participates in the motion of rotation proper to that part of the earth's surface. Now, we are well aware, that the rotatory velocity is greater in the equatorial regions, than in those nearer the poles; if, therefore, currents of air set in from the north and south towards the equator, these, not having the same velocity of rotation as the earth in those regions, must pause or hang back, in a direction opposite to that in which the earth is revolving on its axis, *i. e.*, from east to west. It will be evident that these currents, were it not for the earth's rotation, would be simply northerly and southerly winds, but from this cause they acquire a relative direction from the east, and assume the character, in the respective hemispheres, of permanent north-easterly and south-easterly winds. In the centre of this zone, however, these causes cease to act, and the wind altogether loses its easterly character; so that the equatorial belt is comparatively calm, and free from any steady prevalence of easterly wind. The result of these variations is the existence of two great tropical belts, in the northern of which a north-easterly wind, and in the southern of which a south-easterly wind, must continually prevail.

To the same causes may be attributed the prevalence of westerly winds in higher latitudes. The air, which has become heated in equatorial regions, in rising and flowing towards the poles, carries with it the rotatory velocity due to its equatorial situation, into latitudes where the earth's surface has less

motion; hence, as it travels northwards or southwards, it will advance at a more rapid rate than the earth's surface in the regions it now occupies, thus giving rise to the north-westerly gales of the higher latitudes of the southern hemisphere, and the south-westerly gales so prevalent in our latitudes, as well as the almost constant westerly winds of the North Atlantic.

But although the trade winds blow with remarkable constancy in the wide ocean, their general direction is affected by the proximity of land, and a deviation from their regular course may be observed near the shores of America, and yet more strikingly off the coast of Africa, in which region, especially in the vicinity of the Sahrà, the air becomes more heated than over the sea, giving rise to sudden changes and violent storms, which are of frequent occurrence on that coast.

The *monsoons*, or periodical winds of the Indian Ocean, also owe their origin to the proximity of land. In the southern portion of the Indian Ocean, which is remote from this cause of disturbance, the trade-wind blows from the south-east with its wonted regularity; but in the seas between Sumatra and Africa, which form its northern belt, the course of the trade-wind is reversed for half the year, during which period there is a constant wind from the south-west. This change occurs from April to October, and appears to be occasioned by the great rarefaction of the atmosphere, in the extensive regions of Southern Asia, at that season of the year, the sun being then north of the equator. These winds are distinguished as the south-west and the north-east monsoons; the former of which, passing over the ocean, arrives charged with moisture, and depositing copious supplies of rain, renders the vegetation of India so splendid and beautiful at that season of the year.

Sea-breezes are produced by causes similar to those which give rise to the south-west monsoon. The surface of land being more heated during the day than that of the sea, and the air consequently becoming rarefied, rises, and the cooler air, being heavier, rushes in from the surface of the sea, thus giving rise to the sea-breeze; this usually commences about ten A.M., and

continues throughout the day, until about six in the afternoon, when it gradually dies away. In some situations the reverse takes place at night, the sea at that time retaining a higher temperature than the adjacent land, and causing a *land-breeze* to rise; this usually commences about eight in the evening, and dies away before six or seven in the morning; it is much fainter and less regular than the sea-breeze, and also of much less general occurrence, requiring particular conditions of surface for its production:—the sea-breeze, on the other hand, is more or less felt on the coasts of all warm countries, and in hot sunny weather may even be observed on our own shores.

In temperate climates, the winds are far less regular than in tropical regions, the general causes which produce them acting with less force and constancy, and the disturbing causes being, therefore, less under control. The most prevalent winds of Great Britain are from the south-west, attributable, as we have just seen, to equatorial heat and the rotation of the earth.

The *hurricanes* of the West Indies, the *typhons* of the China Seas, and the *ox-eye* of the Cape, where,

> . . . . . Amid the heavens,
> Falsely serene, deep in a cloudy speck
> Compressed, the mighty tempest brooding dwells,

are all violent and extraordinary agitations of the air, appearing to have a rotatory motion, being analogous to whirlwinds, and sweeping round, in a regular course, from one point of the compass to another. The *tornadoes* of the western coast of Africa, the *pamperas* of South America, and the storms called *arched squalls*, are considered by Colonel Reid to be of a different character.

The *sirocco* of Italy and Sicily, and the *solano* of Spain, as well as the *simûn*, or *simoon*, of Arabia, and the *harmattan* of Western Africa, are all winds which owe their origin to the heated surfaces of the sandy districts of Arabia and Africa. The principal difference between these winds appears to be, that the two former acquire some moisture in crossing the Mediterranean, and consequently have not that excessive aridity which characterizes the simûn and the harmattan.

CHAPTER VI.

CLIMATE.

. . . . . . All around
Thine equal rays are resting found,
Yet varying so on various ground
They pierce and strike,
That not two roseate cups are crowned
With dew alike. *Christian Year.*

THE term *climate* is used to express the combination of temperature and moisture which prevails in any particular region. The most prominent causes of diversity of climate are—the heat of the sun; the relative position of land and water; and the elevation of land above the level of the sea. To these may be added, as producing considerable, though less marked effects: the nature of the soil; the prevailing winds; the position of mountain ranges; and the currents of the ocean.

The sun is the grand agent in diffusing heat over the surface of the globe; the temperature of any part, mainly, if not wholly, depending on its exposure to his rays: this being, however, modified by circumstances; the power of the sun's rays being great in proportion to the vertical direction in which they strike the earth. Whenever the sun is above the horizon of any place, that place is receiving heat; when below, parting with it, by the process called *radiation*. Whenever, therefore, the sun remains more than twelve hours above the horizon of any place, and consequently less than twelve hours beneath, the general temperature of that place will be above average; and when the reverse occurs, it will be below average. As the earth revolves on its axis, successive portions of its surface are heated by the solar rays; and, owing to "the simple yet stupendous contrivance of the inclination of the axis of the earth to the plane of its orbit," the northern and southern hemi-

spheres are brought alternately more directly under the solar influence; and not only do we thus enjoy the varieties of day and night, and the grateful change of the seasons, but by this means the heat of the intertropical zone is moderated, and the limits of the temperate regions greatly extended.

The division of the earth into five *zones*, the torrid, the two temperate, and the two frigid, may convey a general idea of the temperature of these respective portions of the earth's surface; and in fact, did the temperature of any place depend solely on the heat of the sun, this arrangement, or any other, dividing the earth's surface into parallel bands, might present a correct indication of the temperature of each zone. The power of the sun's rays is, however, so modified by other circumstances, that great varieties of temperature are observed to prevail in countries situated in the same parallels or degrees of latitude. Thus, by some observations recently made at New Archangel, on Sitka Island, situated immediately off the western coast of North America, in lat. 57°, it appears that the mean annual temperature at that place is nineteen degrees higher than at Nain, on the coast of Labrador, in the same parallel of latitude. The difference between the winter temperature of the two stations is yet greater, amounting to no less than thirty-six degrees. At Sitka, the snow never lies long on the ground, but usually disappears as soon as it falls. In Labrador, on the other hand, there are hardly two months of the year perfectly free from ice and snow; and the latter accumulates on the plains near the sea, to the depth of twenty or twenty-four feet. In the interior of the continent, at Fort Chippewyan, in the same parallel, the summers are much hotter than at Sitka, and the winters more severe even than at Labrador, the thermometer sometimes falling to 20° or 30° below zero. Nor is this remarkable difference of climate confined to America; it is also observable in the Old World, of which the respective climates of Kamtchatka and Great Britain may be mentioned as an instance.

This variation of climate appears, in great measure, to be

attributable to the different arrangement of land and water, which has been already mentioned as one of the principal causes of diversity of climate.

The waters of that great "climate agent," the ocean, are of very equal temperature, and have, therefore, a tendency to preserve a similar mean, or equal temperature, wherever their influence extends, moderating alike both heat and cold. Thus, when a cold wind passes over the sea, it becomes warmed, and the cold of winter will be moderated. A hot wind, on the contrary, becomes cooled in passing over the sea, and the summer temperature of the adjacent regions will be lowered. And hence we find that the climate of islands, and of countries bordering on the sea, differs considerably from that of the interior of continents, the former being usually characterized by milder winters and more temperate summers. Such countries are said to possess an *insular climate*. When, on the other hand, any region experiences great severity of cold in winter, and at the same time, a considerable degree of heat in summer, it is said to possess an *excessive climate*. Thus, Sitka has an insular climate, the summer temperature being low, and the winter moderate; but Fort Chippewyan presents an instance of an excessive climate. Labrador, from its *littoral* or coast situation, might seem entitled to an insular climate, but the difference between its climate and that of Sitka, is supposed by M. Baer to arise from the configuration of the land; Sitka being completely screened from the influence of the circumpolar regions by the peninsular Alyaska, and its continuation in the Aleutian Isles, which in general form a range of high land, protecting it from the north and east, and preventing the ice of the arctic regions from drifting to its shores; whilst, at the same time, it is open to the influence of the warm currents flowing from the equatorial regions of the Pacific. Labrador, on the contrary, has no intervening land to protect it from the north, or from the icebergs which are formed in Baffin's Bay, from whence a current sets southward, bearing these icy masses past its shores. A similar cause is also assigned, by M. Baer, for the temperate climate of the western shores of the Old

World; that being preserved from extreme cold by the protection afforded by Nova Zembla, and a submarine ridge extending from thence to Spitzbergen, which forms a barrier to the ice accumulated on, and borne down by the great rivers of Siberia.

The effect produced on climate by the relative position of land and water, is exhibited on a large scale in the difference of climate observable in the northern and southern hemispheres. The space occupied by the waters of the ocean is much greater in the southern than in the northern hemisphere, the consequence of which is, that a much more equable temperature prevails in the former than in the latter. Thus, in Tasmania, or Van Diemen's Land, which is situated about the same distance south of the equator, as Rome is to the north of that line, the winters are milder than at Naples and the summers not warmer than at Paris.

It is, however, a remarkable fact, that in high latitudes in the southern hemisphere, the cold is much greater than in similar parallels in the northern hemisphere. Thus, in the island of Georgia, which is in the same latitude as Yorkshire, the ground is covered with snow at all seasons of the year. This greater severity of climate has been supposed to arise, partly from the absence of any large surface of land in the temperate region of the southern hemisphere, capable of reflecting the heat of the sun, and partly from the occurrence of some yet undiscovered elevated land within the south polar circle; to which may be added, the want of any protecting ridge to screen it from the cold of the latter regions, and the floating ice-bergs, which are borne from thence by the currents of the ocean.

The *elevation of land above the level of the sea,* is another leading cause of the diversity of climate. We have already seen that the air becomes rarefied, or less dense, as we ascend above the level of the sea; we also find a gradual decrease of temperature, in proportion to the elevation of land above that level, (this decrease being about one degree of Fahrenheit for every 656 feet,) until we attain a point where perpetual

congelation takes place. This point, which is called the snow-line, or line of perpetual snow, varies in different latitudes, and even in similar latitudes under different conditions; but, generally speaking, a gradual decrease in the elevation of the snow-line above the sea level takes place, as we approach the frozen regions of the polar circles. The limit of the snow-line within the tropics, is about 16,000 or 17,000 feet above the level of the sea; and in the northern hemisphere, this line descends to the level of the sea, at about latitude 80°. In the southern hemisphere, as we have just seen, the shores of the island of Georgia, situated in latitude 56°, are covered with perpetual frost; it will therefore be evident that the same rules will not apply to both hemispheres; little, however, is yet known on this subject relative to the southern hemisphere, but the following table will convey a general idea of the snow-line in the northern hemisphere, though, owing to local variations, this can only be regarded as an approximation to the truth:—

TABLE OF SNOW-LINE.

Latitude.	Elevation in feet.
0°	16,000
10	16,500
20	17,000
30	14,000
40	10,000
50	6,000
60	5,000
70	1,000
80	0

In considering the above table, we shall perhaps feel some surprise, at finding the snow-line higher at the distance of twenty degrees from the equator, than at the equator itself. This, however, is readily explained by the circumstance that, at the equator, the sun is never more than twelve hours above the horizon; whereas near the tropics, the longest days are thirteen hours and a-half in length; and, as the sun at that period is vertical or nearly so, the *summer* heat on which the line of

perpetual snow depends, is greater than directly under the equator.

The gradual decrease of temperature at increasing elevations above the level of the sea, has a marked and very beneficial effect; in diversifying the climates over the surface of the globe, and in fitting it for the production and maintenance of an almost endless variety of plants and animals. All countries situated between the tropics are subject to an excessively high temperature; and in such localities, when the land is nearly level with the sea, the heat is extreme: and unless furnished with most abundant supplies of rain, they present a highly parched and arid appearance: such regions being more destitute of vegetation and consequently of animals, than almost any others on the surface of the globe. Of this description is the Sâhra, or Great Desert of Africa. Where tracts of land occur, similar in latitude and elevation, but abundantly supplied with rain, the most luxuriant fertility prevails, enlivened by innumerable tribes of animated beings, but usually insalubrious, and unfitted for the abode of man. Such are the swampy and pestilential shores of Comayagua, or Honduras. At an elevation of about 3,000 feet above the sea, however, a totally different climate prevails; thus the elevated lands of Central America, at no great distance from the last-mentioned district, are described by Colonel Galindo, as presenting the most delightful climate imaginable, where "perpetual spring and verdure ever exist, and realize the dream of the ancient European poets, who, without experiencing it, imagined a similar climate for their favourite Elysian fields, or the island of Calypso." At still greater elevations we arrive at the line of perpetual snow. The mountains of Central America, or Guatemala, however, scarcely attain that height above the sea; but the Andes present a vast number of snow-capped summits within the torrid zone.

The snow-line, as has been already observed, is subject to variation in different localities, though situated in the same parallels of latitude. Thus it appears that an elevated plain, or table-land, in the vicinity of a mountain, tends to elevate the temperature of the mountain, and consequently to raise the

snow-line, which will be found to be higher on a mountain so situated than on one that is isolated, or where the ascent is more sudden and precipitous. As it has just been stated, that the temperature of elevated land is not so high as that of low plains, we might expect the very reverse to be the case. A familiar illustration, if we may be permitted to introduce it, will perhaps afford the clearest explanation of this phenomenon.

The higher temperature on mountains so situated, appears to be owing to the effect produced on the atmosphere by the radiation, and perhaps also the reflection of the sun's rays from the high table-land; an effect very similar to this may be observed in our own dwellings. If the windows of our apartments are situated near the ground, we may, in hot sunny weather, perceive that the temperature of our rooms is increased by the reflection of the sun's rays, more especially if they fall on a stone pavement, for the amount will vary according to the nature of the surface; and should it consist of turf or meadow land, the reflection will be scarcely perceptible. If, then, we ascend into our upper apartments, we shall find the reflection from the stone pavement—partly owing to the greater distance, and partly to the different angle or direction from the ground to the upper window—will, if not wholly without effect, be far less intense, and will communicate little or no heat to the upper rooms. Should, however, a balcony, or a portico, extend in front of our upper windows, this will form no bad representation of a table-land adjoining a mountain; and will, by reflecting the sun's rays directly into our upper rooms, elevate their temperature.

The stupendous Himalaya mountains afford a striking instance of the effect produced by such an elevated table-land. On the *southern* side of this mighty range, in lat. 30°, the snow-line commences at the elevation of about 12,500 or 13,000 feet above the level of the sea; whilst on the *northern* side, where, from the aspect, we might be led to expect a greater degree of cold, the snow-line does not descend below 16,000 feet above the sea. Our readers will readily perceive that this is capable of a satisfactory explanation, when they are reminded that the

northern declivity of this mountain mass terminates in the immense elevated plains of Tibet, the surface of which exceeds 10,000 feet above the level of the sea; whilst on the southern side, the mountains rise directly to a great elevation, from a flat country scarcely 1,000 feet above the sea, and covered with a close jungle; of all descriptions of surface the least favourable for radiating heat.

In high latitudes, however, where table lands occur of sufficient elevation to be covered with snow during the greater part of the year, the very reverse takes place: and in such situations, the temperature will be lower on mountains so circumstanced, than on such as are isolated. And it has even been observed that in sunny calm weather, the temperature on *isolated* mountains in very high latitudes, increases with the elevation. Thus, in Spitzbergen, the temperature at a lower station was found to be about 36°; and at the summit of a mountain, 1,542 feet above the sea it rose to 40°.

Among the causes which produce some effects on the climate of any region, though not so important as the preceding, is *the nature of the soil.* This is principally owing to the greater or less power any soil possesses of radiating heat. Thus, sandy soils are subject to become rapidly and intensely heated, and when the sun's rays are withdrawn, they readily radiate, or impart to the atmosphere, the heat they have acquired, thus increasing the general temperature. Clayey soils, on the other hand, become slowly heated, and as slowly part with heat. Swampy ground chills the air, and extensive forest tracts have a similar effect. And thus cultivation not unfrequently effects a change in the climate of any country; for if marshes are drained or forests cleared, the temperature will be raised. Such has been the case in some parts of North America, where the clearing of the forests and the progress of cultivation have improved the climate and rendered the winters milder. The destruction of woods has, however, proved highly detrimental to the climate of some regions. Thus the sultry atmosphere and dreadful droughts experienced in the Cape Verde Islands, are attributed to the destruction of the trees in those islands;

whilst a remarkable improvement has taken place in the climate of the Island of Ascension since that has been brought into cultivation.

The prevailing winds produce considerable effect on the climate of any place; and at the same time the character of a wind depends on the nature of the surface over which it passes, and consequently on the configuration of the land, and the relative position of land and water. The prevailing winds of Great Britain and Western Europe, sweep as we have seen across the vast Atlantic Ocean; their character is, therefore, usually mild; and those regions are not subject to extremes of heat or cold. If the wind, in lieu of crossing an expanse of sea, pass over a large tract of land, its character will be greatly influenced by the nature of the surface over which it sweeps. This is illustrated by the character of the easterly winds in the eastern counties of England. These winds before they reach our shores, cross the vast plains of Northern Germany. In the latter part of the spring, the surface of those plains is damp and chilly: and the intervening sea not being of sufficient extent greatly to temper them, they bring with them a cold and chilly character, which, especially in our eastern counties renders these winds at that season so ungenial, and not unfrequently injurious to vegetation. Yet even,

. . . . . These seeming cruel winds
Blow not in vain: far hence they keep repressed
Those deepening clouds on clouds, surcharged with rain,
That o'er the vast Atlantic hither borne
In endless train, would quench the summer blaze,
And cheerless drown the crude unripened year.

But though in spring and early summer these winds are chilly and damp, in the autumnal months they assume a totally different character. At that season, the plains of Germany are usually dry and sandy; they accordingly become warmed, and also radiate a considerable degree of heat. The consequence of which is, that the easterly winds acquire a higher temperature in passing over them; sometimes, indeed, sufficient to raise the thermometer several degrees on our eastern shores at that period of the year.

The *position of mountain ranges* may also be mentioned as producing considerable effects on the climate of any region; more especially if extending from east to west, and thus according to their relative position with regard to the lowland districts, screening them from the north, or leaving them unsheltered in that direction. Of this the different climates of Poland and Hungary afford a striking example. The Carpathian Mountains form the separation between the two countries; and Poland, situated to the north of this range, and having no elevated land to protect it from the piercing blasts which sweep across the plains of Northern Europe, suffers from a very cold and humid climate, the winters being nearly as severe as in Sweden. Hungary on the contrary, sheltered by the Carpathian Mountains from the cold blasts of the north, and sloping gently towards the south, enjoys a milder climate than any part of Germany.

The *currents of the ocean* may be considered as very influential causes of the diversity of climate. The principal currents are produced by the movement of the waters, perpetually setting from the polar regions towards the equator; and by the progression of the tropical seas towards the west: both of which originate in the earth's diurnal rotation. By the laws of mechanics, any fluid body in rotation has a tendency to *culminate*, or accumulate in a heap at the part in most rapid motion; and accordingly we find the waters of the polar circles naturally flowing from their own stiller region, to that of the more rapidly revolving equatorial zone. Powerful currents are thus formed; which in some instances bear with them vast masses of ice, these being carried to a greater or less distance according to local circumstances, and producing, as we have already seen, so chilling an effect on the climate of Labrador; and probably yet more influencing that of the island of Georgia, in the southern hemisphere. But the water when arrived in the equatorial regions, (like the aërial currents already described,) has not a rotatory motion of equal velocity with that of this portion of the globe; and, consequently, has an apparent motion from east to west. Water also like air has less density at a high tempe-

rature than when it is cold; and thus the greater warmth of the ocean in intertropical regions will cause it to flow in an upper current towards the poles. A mutual interchange is, therefore, continually taking place between the waters of the warm and cold regions of the globe.

The equatorial, or easterly current, is very apparent, both in the Atlantic and the Pacific, between the parallels of 30° on each side of the equator; having a mean velocity of nine or ten miles per day in the open sea. The waters which form this current, being generally about three or four degrees cooler than those of the waters under the line, tend to moderate the heat within the tropics.

The most powerful and influential of known currents, however, is that called the Gulf Stream, which has its source in the Gulf of Mexico, where the water, like that of the Mediterranean, and other inland seas in warm latitudes, has a higher temperature than the wide ocean in similar parallels. The temperature of the water in the Mexican Gulf, in summer, is 86°, this being at least seven degrees higher than that of the Atlantic in the same latitude. From this great reservoir of warm water, a constant current pours through the Straits of Bahama, taking a north-easterly course, at the rate of three or four miles an hour. As it proceeds northwards, it flows with diminished velocity, until it is lost on the banks of Newfoundland, where it encounters the great current from the Polar regions. Its course may be traced, not only by its effect in retarding, or speeding, the progress of ships, but more particularly, by the higher temperature it retains; for, in N.L. 42°, its waters have still a temperature of 71°, whilst that of the adjacent sea, beyond its influence, is 8° lower, or 63°. It reaches the Azores in seventy-eight days, after flowing nearly 3,000 geographical miles.* From thence, extending its course 1,000 miles further, it arrives at the Bay of Biscay, still retaining an excess of 5° above the mean temperature of the sea. And as it has been known to reach this spot in the months of November and January, it probably tends greatly

* About 3,150 British statute miles.

to moderate the cold of winter in Western Europe; along the whole shores of which it is supposed to extend: an inference drawn, not merely from the comparatively high temperature of the British Isles, and of that portion of the continent, but also from the fact, that various seeds and other tropical productions, are occasionally deposited on the shores, even as far north as Norway.

A large tract occurs in the centre of the North Atlantic Ocean, between the parallels of 33° and 35° north latitude, not much less than 2,000 miles in length from east to west, and about 350 in width, which has been called by Major Rennell, "the recipient of the gulf water." A considerable portion of this area is covered by the sea-weed called sargasso, which the current floats in abundance from the Gulf of Mexico. This mass of water is nearly stagnant, and is warmer by 7° or 10° than the waters of the Atlantic in that parallel; its heat being maintained by constant supplies of warm water from the south; and there is reason to conclude that the general climate of some parts of Europe and America, may be materially affected by this vast surface of warm water.

It thus appears, that the diversities of climate are chiefly dependent on latitude; on the distribution of land and water; and on the elevation of land above the sea: as also on the nature of the soil; the prevalence of particular winds; on currents of the ocean; and some other local circumstances. The causes which affect climate being thus various, it will be evident that great differences of temperature will prevail in different regions, even though situated in similar parallels; and it can only be from actual observations, that the distribution of heat over the earth's surface can be ascertained. This has, in great measure, been effected by De Humboldt; who, from accumulated observations, made by himself and others, has deduced the lines of equal temperature over a considerable portion of the globe. These lines, which are termed *isothermal lines**, are, excepting perhaps within twenty-two degrees of the equator, neither parallel with that line, nor with each

* From *isos*, equal, and *therme*, heat.

other; being, generally speaking, higher in the western than the eastern regions, both in the Old and New World; and descending lower in America than in Europe; this difference increasing as we recede from the equator. Thus, the isothermal line of 59° Fahrenheit, passes in Europe between Rome and Florence, in lat. 43°; but near Raleigh, in North Carolina, it descends to lat. 36°. The line of mean equal temperature of 50°, passes through the Netherlands, in lat. 51°; whilst at Boston, in the United States, it descends to lat. 42½°. The line of the freezing point passes through Uloa, in Lapland, between 66° and 68° north lat.; and at Table Bay, on the coast of Labrador, it descends to lat 54°, a difference of above 12° of latitude occurring in the latter instance.

When we speak of the *mean annual* temperature of any place, or places, it is, however, by no means necessarily implied, that their climates should correspond. The mean temperature of any station is determined by ascertaining the average temperature of each day in the year, and taking the mean of the whole. And thus, if we were desirous of knowing the mean temperature of the coldest day of winter, and the hottest day of summer, at any two given stations, and we find those of the one station to have been respectively 40° and 60°, and those of the other to have been 20° and 80°; if we add each of these together, and divide them by two, we shall perceive that the *mean* temperature at both stations will have been 50°; but it will be evident, that though this may be similar, the *climate* of the two stations will differ.

Such we shall find to be the case with the annual temperature of various places through which these isothermal lines may pass. In some, the winters may be mild and the summers only moderately warm, whilst in others the extremes of heat and cold may be experienced. Thus, the mean annual temperature of England is 50°, the mean summer temperature being about 63°, and the mean winter about 37°, making a difference of twenty-six degrees; at Pekin the mean annual temperature is 51°, the summer temperature being 79° and the winter 23°, making a difference of not less than fifty-eight

degrees. The mean annual temperature in these cases is not widely different, but the climate of the two places is wholly dissimilar, the one possessing an insular, and the other an excessive climate.

The difference between the mean summer and winter temperature is usually much less between the tropics than in temperate zones. Thus, at Cumana, which is situated in 10° north latitude, there is only a difference of four degrees between the temperature of the warmest and coldest months.

The greater part of the above-mentioned variations, are accounted for by the causes of diversity of climate already enumerated. Some of the phenomena of temperature and climate appear, however, as far as our present knowledge extends, incapable of explanation by these ordinary causes of variation. Such is the supposed occurrence of two regions of *maximum* or *greatest cold* on both sides of the equator. The position of those in the southern hemisphere has not been determined. In the northern hemisphere the regions, or as they are termed *meridians of greatest cold*, are both situated in about the eightieth parallel of latitude, and (widely speaking) about 100° east and west longitude. The mean annual temperature at the North Pole, is supposed to be about 4° or 5° Fahrenheit; the temperature at these stations is considerably lower; that of the eastern or Asiatic meridian being nearly 1° Fahrenheit; and that of the western or American meridian of greatest cold, about 3½° below zero. It is not impossible that future researches may show, that these meridians of greatest cold, are attributable to the circumstance of those regions being excluded from causes tending to moderate their climate.

The innumerable diversities on the surface of the globe, to which the various combinations of climate, soil, and temperature give rise, adapt the earth in a remarkable manner for the organized beings with which it is covered. Had a uniform climate been communicated to the whole earth, or even had there been no undulations on its surface, and no alternations of land and water, its productions would, in all probability, have

been comparatively limited in variety and number; as at present constituted, however, we find that the bountiful Creator has not only given us abundance, but also almost endless variety, affording us unbounded scope for research, and for admiration of the supreme wisdom which is displayed in every part of the natural world; and thus leading us to feel and to acknowledge that

> . . . . Needs must the Power
> That made us, and for us this ample world,
> Be infinitely good, and of this good
> As liberal and free as infinite.

KEY TO THE PLATE OF

GEOGRAPHICAL DISTRIBUTION OF PLANTS.

EXOGENÆ.

1	Oriental poppy,	Papaver orientale.
2	Egyptian lotus,	Nymphæa lotus.
3	Sacred bean,	Cyamus nelumbo.
4	Nutmeg,	Myristica moschata.
5	Tulip tree,	Liriodendrum tulipiferum.
6	Winter's bark,	Drimys winteri.
7	Persian ferula,	Ferula persica.
8	Carrot,	Daucus carota.
9	Caraway,	Carum carui.
10	Ginseng,	Panax quinquefolium.
11	Scarlet ribes,	Ribes sanguineum.
12	Vine,	Vitis vinifera.
13	Mangrove,	Rhizophora gymnorhiza.
14	Brown gum tree,	Eucalyptus robusta.
15	Allspice tree,	Myrtus pimento.
16	Clove tree,	Caryophyllus aromaticus.
17	Pomegranate,	Punica granatum.
18	Lapucaya nut,	Lecythis ollaria.
19	Cucumber,	Cucumis sativus.
20	Melon,	——— melo.
21	Melon cactus,	Melocactus.
22	Peruvian cactus,	Echino cactus.
23	Cochineal cactus,	Opuntia cochinilifera.
24	Hottentot's fig,	Mesembryanthemum edule.
25	Turnip,	Brassica napa.
26	Caper plant,	Capparis spinosa.
27	Papaw tree,	Carica papaya.
28	Mangosteen	Garcinia mangostana.
29	Tea tree,	Thea viridis.
30	Sugar maple,	Acer saccharinum.
31	Tatarian maple,	——— tataricum.
32	Broad leaved maple,	——— macrophyllum.

33 **Flax,**	**Linum usitatissimum.**
34 **Silk cotton tree,**	**Bombax ceiba.**
35 **Baobab,**	**Adansonia digitata.**
36 **Cacao, or chocolate tree,**	**Theobroma cacao.**
37 **Cotton plant,**	**Gossypium herbaceum.**
38 **Nankin cotton,**	**———— religiosum.**
39 **Camphor tree,**	**Dryobalanops camphora.**
40 **Linden, or lime tree,**	**Tilia europea.**
41 **Hennéh, or chenna,**	**Lawsonia inermis.**
42 **Mahogany,**	**Swietonia mahagoni.**
43 **Orange tree,**	**Citrus aurantium.**
44 **Lemon tree,**	**——— limonum.**
45 **Citron, or lime,**	**——— limetta.**
46 **Myrrh,**	**Amyris kataf.**
47 **Linear-leaved croton,**	**Croton cascarilla.**
48 **Box,**	**Buxus sempervirens.**
49 **Mandioc, or cassava,**	**Jatropha manihot.**
50 **Caoutchouc tree,**	**Siphonia elastica.**
51 **Tallow tree,**	**Stillingia sebifera.**
52 **Cape Euphorbia,**	**Euphorbia meloformis.**
53 **Great-flowered spurge,**	**———— corollata.**
54 **Manchineal,**	**Hippomane manicella.**
55 **Arctic bramble,**	**Rubus arcticus,**
56 **Cloud berry,**	**——— chamæmorus.**
57 **Strawberry,**	**Fragaria canadensis.**
58 **Apple,**	**Pyrus malus.**
59 **Siberian crab,**	**——— prunifolia.**
60 **Cherry,**	**Prunus cerasus.**
61 **Myrobalan plum,**	**———— cerasifera.**
62 **Apricot,**	**———— armeniaca.**
63 **Almond,**	**Amygdalus communis.**
64 **Indigo,**	**Indigofera tinctoria.**
65 **Gum tragacanth,**	**Astragalus creticus.**
66 **African earth nut,**	**Arachis hypogæa.**
67 **Locust tree, or false acacia,**	**Robinia pseud-acacia.**
68 **Brazil wood tree,**	**Cæsalpinia braziliensis.**
69 **Logwood tree,**	**Hæmatoxylon campæchicum.**
70 **Tamarind,**	**Tamarindus indicus.**
71 **Egyptian cassia,**	**Cassia acutifolia.**
72 **Gum Arabic,**	**Acacia arabica.**
73 **Wattle tree,**	**——— discolor.**
74 **Rosewood tree,**	**Mimosa jacaranda.**
75 **African locust tree,**	**Inga biglobosa.**
76 **Tonquin bean,**	**Dipterix odorata.**
77 **Mango,**	**Mangifera indica.**
78 **Lacquer plant,**	**Stagmaria verniciflua.**
79 **Beech tree,**	**Fagus sylvatica.**
80 **Sweet chestnut,**	**Castanea vesca.**
81 **Oak,**	**Quercus robur.**
82 **Cork tree,**	**———— suber.**
83 **Birch,**	**Betula nigra.**
84 **Weeping birch,**	**——— pendula.**
85 **Shrubby birch,**	**——— fruticosa.**
86 **Dwarf birch,**	**——— nana.**
87 **Alder,**	**Alnus incana.**

88	Common nettle,	Urtica dioica.
89	Hemp,	Cannabis sativa.
90	Hop,	Humulus lupulus.
91	White mulberry,	Morus alba.
92	Paper mulberry,	Broussonetia papyrifera.
93	Banyan tree,	Ficus religiosa.
94	Fig tree,	—— carica.
95	Caoutchouc fig tree,	—— elastica.
96	Bread fruit tree,	Artocarpus incisa.
97	Jaca, or Jack,	———— integrifolia.
98	Cow tree,	Galactodendron utile.
99	Upas tree,	Upas.
100	Elm tree,	Ulmus campestris.
101	Candleberry myrtle,	Myrica cerifera.
102	Illinois nut,	Juglans olivæformis.
103	Black walnut,	——— nigra.
104	Hiccory,	——— tomentosa.
105	Common walnut,	- regia.
106	Casuarina,	Casuarina equisetifolia.
107	Pepper,	Piper nigrum.
108	Weeping willow,	Salix babylonica.
109	Dwarf willow,	Salix adscendens.
110	Hudson's Bay poplar,	Populus hudsonia
111	Italian poplar,	——— dilatata.
112	Black poplar,	- nigra.
113	Aspen tree,	- tremula.
114	American plane,	Platanus occidentalis.
115	Sandal-wood tree,	Santalum album.
116	Banksia,	Banksia speciosa.
117	Cinnamon,	Laurus cinnamomum.
118	Benjamin tree,	——— benzoin.
119	Bay tree,	——— nobilis.
120	Buckwheat,	Polygonum fagopyrum.
121	Rhubarb,	Rheum palmatum.
122	Columbo root,	Menispermum palmatum.
123	Cape heath,	Erica fascicularis.
124	Cranberry,	Oxycoccus macrocarpus.
125	Ebony tree,	Diospyros ebenum.
126	Paraguay tree,	Ilex paraguensis.
127	Crenated convolvolus,	Convolvolus hermanniæ.
128	Sweet potato,	———— batatas.
129	Quinquina,	Cinchona condaminea.
130	Negroes' peach,	Sarcocephalus esculentus.
131	Coffee,	Coffea occidentalis.
132	Teazle,	Dipsacus fullonum.
133	Teak tree,	Tectona grandis.
134	Calabash tree,	Crescentia cujete.
135	Potato,	Solanum tuberosum.
136	Tobacco,	Nicotiana tabacum.
137	Stapelia,	Stapelia asterias.
138	Olive,	Olea Europea.
139	Zamia,	Zamia spiralis.
140	Broad-leaved cycas,	Cycas circinalis.
141	Scotch fir, or pine,	Pinus sylvestris.
142	Siberian stone pine,	—— cembra.

143	Douglas pine,	Pinus taxifolia.
144	Bourdeaux turpentine fir,	—— maritima.
145	Stone pine,	—— pinea.
146	Swamp pine,	—— palustris.
147	Scrub pine,	—— banksiana.
148	Siberian silver fir,	Abies picea.
149	Norway spruce fir,	—— excelsa.
150	Black spruce,	—— nigra.
151	Canada balsam fir,	—— balsamifera.
152	Hemlock spruce,	—— canadensis
153	Common spruce fir,	—— communis.
154	Siberian cedar,	—— sibirica.
155	Cedar of Lebanon,	—— cedrus.
156	Larch,	—— larix.
157	Norfolk island pine,	Araucaria excelsa.
158	Araucarian pine,	—————— imbricata.
159	Arbor vitæ,	Thuja occidentalis.
160	Sandarach tree,	—— quadrivalvis.
161	Deciduous cypress,	Taxodium distichum.
162	Daurian juniper,	Juniperus dahurica.
163	Frankincense,	—————— lycia.

ENDOGENÆ.

164	Ginger,	Zinziber officinalis.
165	Turmeric,	Curcuma longa.
166	Arrowroot,	Maranta arundinacea.
167	Banana,	Musa sapientum.
168	American aloe,	Agave americana.
169	Ixia,	Ixia fucata.
170	Pine apple,	Ananassa.
171	Vanilla,	Vanilla aromatica.
172	Palmetto, or dwarf palm,	Chamærops humilis,
173	Wax-bearing palm,	Corypha cerifera
174	Fan palm,	Corypha umbraculifera.
175	Date palm,	Phœnix dactilifera.
176	Sago palm,	Sagus farinifera.
177	Calamus,	Calamus zalacca.
178	Palmyra palm,	Borassus flabelliformis.
179	Doom palm,	Hyphœne thebaica.
180	Betel-nut palm,	Areca catechu.
181	Cabbage palm,	—— oleracea.
182	Thorn-leaved palm,	Caryota urens.
183	Cocoa-nut palm,	Cocos nucifera.
184	Double cocoa-nut,	Lodoicea sechellarum.
185	Oil palm,	Elais guineensis.
186	Attalea,	Attalea funifera.
187	Wax-coated palm,	Ceroxylon andicola.
188	Onion,	Allium cepa.
189	Garlic,	———— tataricum.
190	Gum dragon tree,	Dracæna draco.
191	Soccotrine aloe,	Aloe soccotrina.
192	Great hedge aloe,	—— ferox.
193	Xanthorrhæa,	Xanthorrhæa hastile.
194	New Zealand flax,	Phormium tenax.
195	Grass tree,	Ringia australis.

196	Hottentot's bread,	Tamus elephantopus.
197	Yam,	Dioscorea sativa.
198	Branching screw pine,	Pandanus candelabrum
199	Screw pine,	—— ——spiralis.
200	Egyptian arum,	Colocasia esculenta.
201	Sugar cane,	Saccharum officinarum
202	Millet, or dhoorah,	Sorghum halepense.
203	Maize,	Zea mays.
204	Rice,	Oriza sativa.
205	Sesamum,	Sesamum orientale.
206	Rye,	Secale cereale.
207	Wheat,	Triticum hybernum.
208	Oats,	Avena sativa.
209	Barley,	Hordeum vulgare.
210	Bamboo,	Bambusa arundinacea.
211	Papyrus,	Cyperus papyrus.
212	Rafflesia,	Rafflesia.
213	Tree fern,	Cyathea arborea.
214	Mushroom,	Agaricus muscarius.
215	Tripe de roche,	Gyrophora.
216	Cudbear,	Parmelia.
217	Iceland moss,	Cetraria icelandica.
218	Reindeer moss,	Cladonia rangiferina.
219	Orchel,	Rocella tinctoria.
220	Sargasso, or gulf-weed,	Fucus natans.

CHAPTER VII.

GEOGRAPHICAL DISTRIBUTION OF PLANTS.

The living herbs, profusely wild,
O'er all the deep green earth, beyond the power
Of botanists to number up their tribes.—THOMSON.

MULTITUDES of different species of plants are spread over the surface of the earth; not indiscriminately, and presenting the appearance of having been scattered at random, but each and all being especially adapted for their natural abodes, or, in other terms, their natural *stations* and *habitations*.

The natural *station* of a plant is determined by the nature of the surface, or soil. Thus, some species confine themselves entirely to water, these being again subdivided into those of the marsh, the lake, the river, and the ocean; other species belong to the land, and of these we find some peculiar to valleys, others to plains, and others to mountains, the latter being distinguished by the designation of *alpine plants*. Some, again, affect a clayey soil, some a chalky, and some a sandy soil; whilst others will thrive only in soils impregnated with soda and muriatic salt. Some plants are parasitical, taking root in the stems and branches of other plants. We also find that some plants flourish only when exposed to the action of strong light, whilst others prefer the shade, and others again spring up even when altogether excluded from light, being formed for tenanting caverns and other dark recesses of the earth.

The natural *habitation* of a plant is dependent on the climate which is best adapted in its perfect development. Thus we find that some species require the hottest climates, others delight in mild and temperate ones, others thrive only in the midst of ice and frost. A large proportion require a constantly humid atmosphere; several succeed in a dry air; though the greater number are equally averse to the extremes of dryness and moisture. Excess of heat, cold, or drought, are the only obstacles to the growth of plants. The result of this remark-

ble adaptation of plants to particular climates, situations, and soils, is, not only that nearly the whole earth is clothed with vegetable life, but also that an almost endless variety exists among these productions, and we are almost tempted to exclaim with the poet,

> The earth was made so various, that the mind
> Of desultory man, studious of change
> And pleased with novelty, might be indulged.

But although some plants, such for instance as the common heath, or ling, affect a sandy soil and temperate climate, we by no means find that the species is met with in all similar circumstanced localities; on the contrary, it usually happens that most species, and some genera, are confined to certain districts, more or less extended. Some species, indeed, are limited to the narrowest bounds;—thus, a species of marjoram (*Origanum Tournefortii*), which was discovered by Tournefort, in the year 1700, in the little island of Amorgos, growing *upon one rock only*, was observed eighty years afterwards on the self-same rock, but has never been met with in any other place. This, it is true, is an extreme case, and most species of plants have a wider range; but we find, that almost every country, or rather perhaps, every natural division of the globe, possesses a *flora*, or assemblage of indigenous plants, peculiar to itself. A considerable difference is even observable between the native plants of the eastern and western districts of Great Britain; and although many species are common to these islands and to some parts of Europe, the number peculiar to our shores is by no means inconsiderable: we shall therefore readily suppose that the plants in distant regions will differ greatly; and accordingly we find that the Old and New World contain a very small number of identical species.

It must be understood that we are speaking of *species*, and of *genera*; for although it is true that some genera, or kinds of plants, may be peculiar to each great division of the globe, this is not generally the case. We, however, frequently find a preponderance of some particular kinds in particular regions. Thus, the saxifrages and mosses are more abundant in the

Arctic regions than any other genera, and also more so in those districts, than in any other portion of the globe Mexico, and the adjacent countries of the New Continent, are characterized by the preponderance of cacti; Southern Africa is marked by that of plants of the mesembryanthemum tribe, &c.

But although it thus appears that plants have their native regions, from whence they have been more or less spread by natural means, or by the agency of man, the geographical distribution of plants over the earth's surface may be considered as mainly dependent on temperature, modified by the moisture or dryness of the atmosphere.

The great influence temperature exercises on vegetation is shown in the different character of the floras of cold, temperate, and hot climates. Vegetation within the tropics fills the European traveller with amazement, by the majesty and vigour of its aspect. The towering height of the trees, the circumference of their stems, the richness and variety of their foliage, as well as the bright and finely contrasted colours of their blossoms, all combine to give splendour to the scene; whilst the graceful foliage, and the columnar stems of the palms and arborescent ferns, give it a peculiar and striking character; and the aromatic plants, the far greater number of which are natives of these regions, fill the air with their perfumes. There, also, gigantic climbing plants tower to the top of the loftiest trees; and magnificent herbs grow to the height of the trees of our orchards, with flowers and foliage not less pre-eminent in their dimensions. As an instance of the gigantic vegetation of tropical regions, we may mention the *corypha umbraculifera*, or fan palm, an East Indian species, which has leaves in the form of an umbrella, eighteen feet across. The *aristolochia*, a plant growing on the River Magdalena, bears flowers of such large dimensions, that, according to De Humboldt, they serve the children for hats.

Some genera of plants are confined exclusively to tropical regions, but the greater number have their representatives, or plants of the same tribe, growing in temperate climates. A comparison of the difference of their dimensions in the different



The Fan Palm.—Corypha Umbraculifera.

regions, will form a striking exemplification of the luxuriance of tropical vegetation, and of the influence of temperature on its developement. Thus the graminæ, or grass tribe, are met with in most parts of the world; in the cold and temperate climates of our quarter of the globe they appear in the form of a dwarf, turfy herbage; in hot regions they are on a greatly larger scale,—the grasses of tropical climates often exceeding the height of twenty-four feet. The *fabaceæ*, called also *leguminosæ*, or pulse tribe, furnish Europe with many herbaceous species, several shrubs, and one middle-sized tree (the laburnum), all of which have leaves composed of a small number of leaflets. The same tribe in hot climates teems with lofty trees, graced with leaves of the most delicate texture, divided and subdivided into numerous leaflets, and playing in the wind like plumes of feathers. All plants of the mallow tribe, with us, are either herbaceous, or small shrubs, and of little importance,—in hot climates they appear in the form of trees, and indeed hold a conspicuous place among the plants of tropical regions, including among their number the colossal *Adansonia digitata*, or baobab tree (Plate IV., fig. 35), the giant of vegetable creation, which is a native of the hot regions of Africa. This tree is supposed to exceed almost any other in longevity. M. Adanson (from whom the tree is named) inferred that a baobab tree which he saw growing at Senegal, and which he carefully examined, must have attained the age of 5150 years*.

Compared with the rich and varied vegetation of intertropical regions, that of Europe appears at first sight poor and insignificant; but although the plants of temperate zones do not rival those of hot climates, either in number of species, or in splendour of appearance, yet the milder regions of the earth, so far from being destitute of important vegetable productions, are, on the contrary, abundantly provided with plants of the greatest utility, bearing the appearance of being constituted expressly for thriving in such climates; nor are these species

* This inference was drawn from the number of concentric rings of annual growth. The trunk of this tree was thirty feet in diameter.

more adapted to arrive at perfection in the torrid regions of the earth, than are equatorial species to thrive in temperate latitudes. We thus perceive that the all-wise and beneficent Creator has beautifully adapted the vegetable productions of the earth to its varied climates; new supplies of species, fitted to thrive in new conditions, perpetually recurring as we recede from the equator to the poles; so that although some species cease to make their appearance, others are met with, to supply the place of those of which we have lost sight.

The rich tropical vegetation, including the palms and arborescent ferns, first gives place to oaks and other inhabitants of temperate climates. These are again superseded by others, which seem to delight in cold,—pines, firs, and birches, constituting the forests which form the natural decoration of a northern land. Birch endures a severe climate better than the other tribes, but becomes stunted as it enters the colder regions, and ceases to grow at N. lat. 70°. Beyond this, shrubs, bushes, and herbaceous plants alone are met with; the dwarf willow, bramble, daphne, and wild thyme, cover the face of the rocks. These at length disappear, and are succeeded by low herbs, furnished with leaves at the root, from the midst of which rises a short stalk surrounded by small flowers,—such are the saxifrages, the gentians, and the primroses. These plants take up their quarters in the clefts of the rocks, whilst the grasses, with their numerous slender leaves, spread themselves over the soil. The lichen, or moss, which forms the food of the rein-deer, sometimes mingles with this turf, whilst at others it covers vast tracts of country, its white tufts looking like hillocks of snow which the sun has not yet dissolved. If we proceed further, sterile soil, or bare rocks, and perpetual snow, everywhere meet the eye, the last vestiges of vegetation being some pulverulent *byssi* and mosses, which spread over the rocks in motley patches.

The above remarks, however, apply more especially to European vegetation, for they are by no means applicable to the southern hemisphere; and even North America (at least its eastern portion), owing to its excessive climate, differs

greatly in the character of its vegetation. In its more northerly latitudes, the greater degree of cold of the New World, arrests the northward progress of many plants which thrive in similar latitudes in Europe; whilst in the parallels of England and France, the greater warmth of the American summers gives a richness of character to its vegetation, which these countries do not possess. Thus, it numbers among its indigenous trees the catalpa, the robinia, or false acacia, called also the locust tree (fig. 67), the tulip tree (fig. 5), besides numerous others of varied and beautiful foliage, and bearing elegant and conspicuous blossoms, among which the magnolia stands pre-eminent, growing in the form of a tree, with the most superb flowers; and this region, from the occurrence of this splendid tree, has been denominated the region of magnolias.

The indigenous trees of our own country, on the other hand, are comparatively little varied in their foliage, and in some species, the blossoms are so insignificant in their appearance, that many persons who connect the idea of a flower with a coloured corolla, are scarcely aware that they have any blossom at all. Of this description are the flowers of the elm, which come forth before the trees are in leaf; and which, owing to the smallness of their size, and the height at which they mostly grow, are principally indicated by a general thickening of the upper branches.

We have already seen that a similarity exists between the temperature of the summits of elevated mountains in the hot regions of the earth, and that of land near the level of the sea in very high latitudes. A remarkable correspondence is also observable between the plants which form the floras of the regions bordering on perpetual snow upon such mountains, and those which constitute the flora of high northerly latitudes. Nor is this correspondence wholly confined to the coldest districts: for although the resemblance is not so striking between the indigenous plants growing in the middle region of a mountain within the tropics, and those of temperate zones, yet a general correspondence occurs; and the native plants of

milder climates are capable of successful cultivation in such situations*.

We thus find, in equatorial regions, that, as we ascend above the level of the sea, vegetation undergoes modifications analogous to those attending its progress to either pole; with this difference, however, that in the one case, the phenomena succeed each other by almost imperceptible gradations, whereas in the ascent of a mountain, they follow in rapid succession. Thus, on the mountains of equinoctial America, the grades of vegetation are displayed to the view of the observer, as on the gradually rising steps of a vast amphitheatre, the base of which is the level of the sea, whilst the summit reaches to the limits of perpetual snow: and the northern and southern hemispheres have not inaptly been compared to two such mountains, placed base to base; the countries under the equator representing the foot, and the north and south polar regions representing the summits enveloped in perpetual snow.

In equinoctial regions, the distribution of plants is much influenced by the mean *annual* temperature; but in temperate zones, it is chiefly dependent on the *summer* temperature,—whether that be sufficient for the plant to ripen its fruit; and also on the *winter* temperature, that is on what degree of cold any plant is fitted to endure. Thus, some plants require a gentle heat of long continuance, and will not stand a severe frost; others thrive best where extremes of heat and cold are experienced, owing to their power of withstanding a considerable degree of cold while their sap is quiescent:

> The north cannot undo them,
> With a sleety whistle through them,
> Nor frozen thawings glue them
> From budding at the prime.

And yet such plants may, when once their sap is set in motion, require a higher degree of heat to bring them to per-

* The genus of plants which possesses the widest range, appears to be the *salix*, or willow tribe; some species of which have been met with in almost every region of the globe, and at almost every elevation above the sea where sufficient moisture occurs to favour their growth.

fection. An acquaintance with the natural habits of plants is of great importance in horticulture. In some species the sap is readily set in motion by the first gleam of sunshine; and in our variable climate, it not unfrequently happens, that warm sunny days of spring are succeeded by sharp frosts. Plants, therefore, which are natives of regions where even a more severe winter prevails than we usually experience, but which is at once succeeded by genial and less variable weather, often suffer, or perhaps perish, in late frosts in this country. Of this, the Norway spruce fir may be mentioned as an instance. But the well-informed cultivator will cautiously avoid exposing such plants (which also include many of the American species we are attempting to naturalize) to a southern aspect at that season of the year. Some plants, it has been remarked, require a certain degree of summer temperature to bring their fruit to perfection. Thus, wheat, to ripen well, requires a mean summer temperature of 57° or 58°; it will not, therefore, succeed in countries where the summer temperature is below that average; and accordingly, it not unfrequently happens that, in cold and rainy seasons, this valuable grain fails of coming to perfection in some parts of England.

The climate of islands is, as we have already seen, much milder or more equable than that of continents; and thus, though London is full two degrees and a half further north than Paris, its climate is so much milder, that many species of plants may be cultivated in the open ground in the vicinity of the British metropolis, which will not thrive without the shelter of a green-house at Paris.

Seventy or eighty thousand species of plants are known to botanists, and unquestionably a large number remain undescribed. The amount of species inhabiting tropical regions bears a very large proportion to that of the inhabitants of temperate climates, and these again are much more abundant than those of arctic regions. Thus, in Spitzbergen, botanists compute that there are not above thirty species, and in Jamaica about four thousand. To obtain, however, a correct view of these proportions, we must ascertain how many species belong

exclusively to particular regions, how many are common to various regions, how many are spread over every portion of the globe;—knowledge which it must require the lapse of ages to acquire*.

One of the great uses to which the vegetable wealth of the earth is applicable, is the benefit of man, whom it in great measure supplies with food and clothing. The all-bountiful Author of Nature has, in almost every region of the globe†, provided certain vegetable productions suited for the food of man, and especially adapted to thrive in those particular climates. By cultivation, man has been enabled to extend the range of many of those valuable plants beyond their natural limits. All plants, as we have seen, require certain conditions of temperature and moisture, and although it would be worse than vain to strive against the provisions of nature, and attempt to introduce plants into regions wholly uncongenial to their nature, or where their produce ceases to be valuable‡, there is no law against spreading every good conferred on man by the beneficent Creator, to all countries capable of profiting by their introduction.

If we turn our attention to the equatorial regions, we find the *banana*, or *plantain* (fig. 167), holding a conspicuous place among plants of especial utility to man. This valuable plant, of the particular species called the banana, forms a primary article of food among the natives of tropical America, where it flourishes luxuriantly in the low plains, but will not ripen its fruit at the elevation of 4,500 feet above the sea; nor can it be

* M. Decandolle estimates the total number of existing vegetables at from 110,000 to 120,000.

† It is mentioned by some authors, as "a fact, notorious as surprising, that no one vegetable belonging to the countries towards the South Pole produces a single fruit fit for the food of man." This assertion is, however, disproved by the recent travels of Sir J. Alexander, in South Western Africa; he having met with, near Walvisch Bay, "an admirable fruit, about the size of a shaddock, on which the natives subsist for two or three months in the year."

‡ Thus the ash yields manna in Calabria, but loses that quality as it advance into the north.

cultivated with advantage further north in the New World than lat. 27°; though in Syria, the species called the plantain, succeeds as far north as lat. 34°. The *jatropha manihot, mandioc*, or *cassava root* (fig. 166), from which we obtain our tapioca, forms another important article of food in South America, and an Indian, after severe toil, will make a hearty meal on three ripe plantains, and a small portion of cassava bread. The *convolvolus batatas*, or Spanish potatoe (fig. 128), also forms a valuable article of food in the New World, as far north as lat. 36°.

The graceful *cocoa-nut palm* (fig. 183), also belongs to intertropical climes, flourishing especially on islands, and near the sea shores, and affording abundant supplies of food to the natives of those regions. Its range may be considered as terminating nearly where that of wheat commences. The *date* (fig. 175), another species of palm, yields one of the most nutritive fruits in existence. This valuable plant thrives especially in a hot and dry climate, thus being of peculiar utility in furnishing food for the inhabitants of the sun-burnt plains bordering on the deserts of Africa and Arabia; to which, however, the date-palm is not wholly confined, as it grows in the Canary Islands, and its range extends to Palestine and Hindostan. It has been introduced into the south of Spain.

The very valuable *bread-fruit tree* (fig. 96) is indigenous to some parts of South-eastern Asia, and also to the Polynesian Islands; of which latter, as well as of the East Indian archipelago, the *yam* (fig. 197) is also a native. This plant is much improved by cultivation, and has been very generally and successfully spread in intertropical countries.

The *pandanus*, or screw pine (fig. 199), constitutes the principal nourishment of the natives of the Caroline Islands.

Perhaps, however, one of the most extensively cultivated, and at the same time most important nutritive plants, belonging to intertropical regions, is the *maize*, or *Indian corn* (fig. 203). Aided by the joint influence of heat and moisture, it shoots up luxuriantly, and yields the most astonishing produce. Nor is it by any means wholly confined to intertropical regions; for,

though it may not flourish with equal vigour, it can be successfully cultivated in any district where the mean summer temperature is about 68°; maize, accordingly will thrive in some parts of France, and is raised in great abundance in the department of Sarthe. It is also cultivated in other parts of Europe; but the summers in Great Britain are usually too cold to admit of its coming to perfection in this country. In Asia it extends to about latitude 48°, and to 46° in America.

The small species of grain called *millet*, or *dhoorah* (fig. 202), does not succeed further north than lat. 45° or 47°. This grass, little productive as it appears, almost entirely furnishes some populous districts with nourishment, particularly in various parts of Asia and of Northern Africa.

Rice (fig. 204) has been cultivated in the southern regions of Asia, from the remotest antiquity. It requires abundance of water, and a mean summer temperature of about 74°; and Piedmont presents the most northerly district in which it can be cultivated with advantage; all attempts to introduce it into this country must, therefore, prove unsuccessful. Perhaps, of all plants, rice furnishes food for the greatest number of human beings, for, besides being most extensively used among the negro population in its adopted country, America, it constitutes the staple food of the various Indian tribes, the Chinese, Japanese, &c. And in such estimation is it held by the natives of the Indo-Chinese countries, that on being informed by a recent traveller that Great Britain produced no rice, they evidently regarded its inhabitants as objects of pity, expressing their surprise that they could possibly subsist without rice.

The range of the *sugar cane* (fig. 201) extends in America to about lat. 30°, on each side of the equator, and in the Old World to about lat. 35° or 36°.

Neither the *olive* (fig. 138) nor the *vine* (fig. 12) come to perfection at the level of the sea under the equator. The range of the olive in the Old World embraces two zones or bands, north and south of the equator, about nine degrees in width, from lat 35° to lat 44°. The climate of the New World is not favourable to the culture of this plant, as it suffers both from

the extremes of heat and of cold to which that continent is subject. The vine comes to perfection in Europe, as far north as lat. 50° or 52°; its range in America is much more limited, a difference of ten degrees occurring between its northerly limits in the Old and New World. Its profitable culture in Europe does not however extend much beyond lat. 48°, and the best wines are produced between 30° and 45° north latitude. The grape, in the south of Europe, abounds in matter of a sweet quality; in the north it contains an excess of acid; thus forming a striking illustration of the influence of temperature in bringing fruits to perfection. These plants being propagated by layers, and their perpetuation not being, therefore, dependent on the ripening of the seed, they may be cultivated in less genial climates, for, as long as the degree or duration of heat is sufficient for their organic functions to be carried on (and even when these are carried on imperfectly), these plants will continue to grow, but their growth is stunted, and they produce no fruit.

Among the plants of utility for the food of man, the *Cerealia*, or all kinds of bread corn, hold a foremost rank. These valuable productions do not succeed at or near the level of the sea in intertropical regions, but may be cultivated in elevated stations, even under the equator. Thus, *wheat* comes to perfection in equinoctial regions between the levels of 4500 and 10,000 feet above the sea. The range of oats is rather more elevated; and that of barley higher than oats. In the temperate zones of the Northern hemisphere, the climate best adapted for the growth of wheat may be considered as commencing at about lat. 30°; but the northern limit varies greatly in different regions, with their varying climates. Thus, in Great Britain the most northerly successful cultivation of wheat is near Inverness, about lat. 58°; but in Norway, this grain comes to perfection at Drontheim, lat 64°, which appears to be its extreme northern limit; in America it has not hitherto succeeded beyond lat. 58°. *Oats* and *rye* do not require so high a summer temperature to ripen them, and therefore succeed in more northern latitudes than wheat. Rye, however, on approaching

to maturity, requires dry weather, which renders it more adapted for continental than insular cultivation. But of all the Cerealia, *barley* has the most northern range. This grain, except in particularly unfavourable seasons, succeeds in the Orkney and Zetland Isles; and in Western Lapland its cultivation extends nearly to lat. 70°.

Of all the vegetable productions especially adapted for the sustenance of man, the *potatoe* (fig. 135) has the widest range. According to De Humboldt, the culture of this invaluable root extends from the extremity of Africa to Labrador, Iceland, and Lapland. This, however, must be understood with some limitation, for it will not thrive in the lowlands of intertropical regions, but is cultivated with great success at the elevation of 8000 or 9000 feet above the sea. At San Mateo, in Peru, the potatoe is grown at the height of nearly 11,000 feet. South America is considered as the native country of the potatoe; and it is well known that it was introduced into Britain from Virginia by Sir Walter Raleigh, in 1586, though many years elapsed ere it was generally adopted in this country as an article of food. At the present day, however, not only does this root form the staple food of a large portion of the population of these isles, but wherever the British have obtained a footing on the face of the globe, there has the potatoe been introduced. The northern limit of the cultivation of the potatoe, may be regarded as forming the boundary line between the agricultural occupiers of the soil, and the nomadic, or wandering tribes, who derive their subsistence from the chase, or from the produce of the sea; for, though, beyond the region of potatoes, a few edible lichens, and some wild roots, valuable as accompaniments to animal food, may be met with, no plants occur, adapted to furnish man with a continued supply of nourishment.

A vast abundance of other plants, which, though not of equal importance with those to which we have now been directing our attention, are highly useful in contributing to the sustenance of man, occur in various parts of the globe. To some of these we shall have occasion to refer in future pages of this work.

KEY TO THE PLATE OF

GEOGRAPHICAL DISTRIBUTION OF ANIMALS.

MAMMALIA.

1 Oran-outang,	Pithecus satyrus.
2 Chimpanzee,	——— troglodytes.
3 Mona monkey,	Simia mona.
4 Striated monkey,	Hapale communis.
5 Chacma baboon,	Cynocephalus porcarius.
6 Ring-tailed macauco,	Lemur catta.
7 Vampire,	Phyllostoma spectrum.
8 Roussette bat,	Plecotus timoriensis.
9 Flying cat,	Galeopithecus volans.
10 Radiated mole,	Condylura cristata.
11 Lion,	Felis leo.
12 Puma,	——— concolor.
13 Tiger,	——— tigris.
14 Jaguar,	——— onca.
15 Ocelot,	——— pardalis.
16 Leopard,	——— leopardus.
17 Chetah,	——— jubata.
18 Lynx,	——— lynx.
19 Chaus,	——— chaus.
20 Canadian lynx,	——— canadensis.
21 Hyæna,	Hyæna vulgaris.
22 Aard wolf,	Proteles cristata.
23 Wolf,	Canis lupus.
24 Esquimaux dog,	——— familiaris var.
25 Arctic fox,	——— lagopus.
26 Jackall,	——— aureus.
27 Polar bear,	Ursus maritimus.
28 Grizzly bear,	——— ferox.
29 Tibet bear,	——— tibetanus.
30 Brown bear,	——— arctos.
31 Glutton, or wolverine,	Gulo luscus.
32 Racoon,	Procyon lotor.
33 Coati-mondi,	Nasua fusca
34 Sea otter,	Lutra maritima.
35 Ermine,	Mustela erminea.
36 Sable,	——— zibellina.
37 Pine marten,	——— martes.
38 Civet,	Viverra civetta.
39 Ichneumon,	Herpestes ichneumon.
40 Ursine seal,	Otaria ursina.
41 Fur seal,	——— falklandica.
42 Elephant seal,	Phoca proboscidea.
43 Common seal,	Calocephalus vitulinus.
44 Walrus, or morse,	Trichecus rosmarius.
45 Kangaroo,	Halmaturus giganteus.
46 Wombat,	Phascolomys fuscus.

47 Flying opossum,	Petaurus sciurus.
48 Virginian opossum,	Didelphys virginiana.
49 Beaver,	Castor fiber.
50 Jerboa,	Dipus jaculus.
51 Chinchilla,	Chinchilla lanigera.
52 Grey squirrel,	Sciurus cinereus.
53 Ground squirrel,	Sermophilus hoodii.
54 Lemming,	Lemmus norvegicus.
55 Porcupine.	Hystrix cristata.
55*Brazilian porcupine,	Synctheres prehensilis.
56 Patagonian cavy,	Dasyprocta patachonica.
57 Capybara,	Hydrochærus capybara.
58 Sloth,	Bradypus didactylus.
59 Armadillo,	Dasypus peba.
60 Chlamyphorus,	Chlamyphorus truncatus.
61 Ant-eater,	Myrmecophaga jubata.
62 Pangolin, or manis,	Manis pentedactyla.
63 Cape ant-eater,	Orycteropus capensis.
64 Platypus, or duck-bill*,	Ornithorynchus paradoxus.
65 Spiny echidna,	Echidna hystrix.
66 African elephant,	Elephas africanus.
67 Indian elephant,	——— indicus.
68 Hippopotamus,	Hippopotamus amphibius.
69 Two-horned rhinoceros,	Rhinoceros bicornis.
70 Indian rhinoceros,	———— indicus.
71 American tapir,	Tapirus americanus.
72 Malay tapir,	—— — malayanus.
73 Peccari,	Dycotyles torquatus.
74 Wild boar,	Sus scrofa.
75 Engallo, or wart hog,	Phascochœres æliani.
76 Babyroussa hog,	Sus babyroussa.
77 Horse,	Equus caballus.
78 Ass,	——— asinus.
79 Zebra,	——— zebra.
80 Camel,	Camelus bactrianus.
81 Dromedary,	——— dromedarius.
82 Llama,	——— glama.
83 Giraffe,	Camelopardalis giraffa.
84 Musk,	Moschus moschiferus.
85 Moose deer,	Cesvus alces
86 Wapiti deer,	——— strongyloceros.
87 Rein deer,	——— tarandus.
88 Chamois,	Antilope rupicapra.
89 Common antelope,	———— cervicapra.
90 Gazelle,	———— dorcas.
91 Algazel,	———— gazella.
92 Mhorr,	———— mhorr.

* The platypus and echidna have been accidentally misnumbered; their proper situation being with the order marsupiata.

93 Gnu,	Antilope gnu.
94 Nylghau,	———— picta.
95 Urus,	Bos aurus.
96 Cape buffalo,	—— caffer.
96*Common buffalo,	—— bubalus.
97 Bison,	—— americanus.
98 Musk ox,	—— moschatus.
99 Yak,	—— gruniens.
100 Ibex,	Capra ibex.
101 Tibet goat,	—— hircus tibetianus.
102 Wallachian sheep,	Ovis aries strepsiceros.
103 Rocky mountain sheep,	—— —— montana.
104 Rytina,	Stellerus borealis.
105 Dugong,	Halicore dugung
106 Common whale,	Balæna mysticetus.
107 Razor-backed whale,	——— physalis
108 Spermaceti whale,	Cachelot macrocephalus.
109 Porpoise,	Phocæna communis.
110 Grampus,	Delphinus grampus.
111 Beluga,	Delphinapterus albicans.
112 Narwhal,	Monodon monoceros.

BIRDS.

113 Golden eagle,	Aquila chrysaëta.
114 Condor,	Sarcoramphus gryphus.
115 Vulture,	Vultur fulvus.
116 Lammergeyer,	Gypaëtos barbatus.
117 Secretary bird, or snake eater,	Gypogeramus serpentarius.
118 Virginian owl,	Strix virginiana.
119 Bird of paradise,	Paradisea apoda.
20 Grey parrot,	Psittacus erythracos.
21 Maccaw,	Macrocercus araranga.
22 Toucan,	Ramphastos pæcilorynchus.
23 Passenger pigeon,	Ectopistes migratoria.
24 Turkey,	Meleagris gallopavo.
25 Superb pheasant,	Phasianus superbus.
126 Emu,	Dromaius ater
127 Cassowary,	Casuarius galeatus,
128 Ostrich,	Struthio camelus.
129 Adjutant,	Ciconia argala.
130 Sacred Ibis,	Ibis religiosa.
131 Flamingo,	Phœnicopterus ruber.
132 Stormy petrel,	Thalassidroma pelagica.
133 Pelican,	Pelecanus thajus.
134 Gannet,	Sula bassana.
135 Southern albatross,	Diomedea fuliginosa.
136 Eider duck.	Somateria mollissima.
137 Black swan,	Cygnus plutonius,
138 Penguin,	Aptenodytes patachonica.

REPTILES.

139 Tortoise,	Testudo mauritiana.
140 Turtle,	Chelonia myda.

141	Gavial,	Gavialis gangeticus.
142	North American alligator,	Crocodilus lucius.
143	South American alligator,	——— sclerops.
144	African crocodile,	——— vulgaris.
145	Iguana,	Iguana tuberculata.
146	Chamæleon,	Chamæleo vulgaris.
147	Surinam toad,	Pipa surinamensis.
148	North American frog,	Rana pipiens.
149	Boa constrictor,	Boa constrictor.
150	Rattle snake,	Crotalus horridus.
151	Cerastes,	Vipera cerastes.
152	Cobra di capello,	Coluber naia.

FISH.

153	Shark,	Scyllium commersonii.
154	Sword fish,	Xiphias gladius.
155	Sturgeon,	Accipensor huso.
156	Electric eel,	Gymnotus electricus.
157	Torpedo,	Torpedo narke.
158	Chetodon,	Platax vespertilis.
159	Saw fish,	Pristis antiquorum.
160	Cod,	Gadus morrhua.
161	Porcupine fish,	Diodon hystrix.
162	Flying fish,	Exocætus exiliens.
163	Cape pike fish,	Tetrapterus herschellii.
164	Herring,	Clupea harenga.
165	Salmon,	Salmo salar.
166	Turbot,	Rhombus vulgaris.
167	Leafy sea-horse,	Hippocampus foliatus.

ARTICULATED ANIMALS.

168	Lobster,	Astacus marinus.
169	Centipede,	Scolopendron morsitans.
170	Scorpion,	Scorpio gigas.
180	Locust,	Acrydium cristatum.
181	White ant,	Termites falatis.

MOLLUSCOUS ANIMALS.

171	Cuttle fish, or sepia,	Loligo octopus.
172	Northern clio,	Clio borealis.
173	Paper nautilus,	Argonauta argo.
174	Common nautilus,	Nautilus pompilius.
175	Bulimus,	Bulimus rosaceus.

RADIATED ANIMALS.

176	Star fish,	Asterias glacialis.
177	West Indian coral,	Madrepora muricata.
178	Isle of France coral,	——— abrotenoides.
179	Cup-shaped pin sponge,	Raphiophora patera.

CHAPTER VIII.

GEOGRAPHICAL DISTRIBUTION OF ANIMALS.

Ye blessed creatures, I have heard the call,
Ye to each other make; I see
The heavens laugh with you in your jubilee;
My heart is at your festival,
My head, too, hath its coronal,
The fulness of your bliss I feel—I feel it all.
WORDSWORTH.

MULTIFARIOUS as are the known vegetable productions of the earth, its animated inhabitants are greatly more numerous; almost every portion of the globe teeming with living creatures.

. . . . . Nor is the stream
Of purest crystal, nor the lucid air,
Though one transparent vacancy it seem,
Void of the unseen people.

The geographical distribution of animals, like that of plants, appears to depend partly on temperature and climate, and partly on local causes. Animals, also, like plants, have their natural stations and habitations, though these are not always capable of being so rigorously determined as those of the latter. Some, however, are remarkably local. Thus, the *mydaus meliceps*, or badger-headed mydaus, an animal intermediate in character between the badger and polecat, and which is an inhabitant of Java, "is confined exclusively to those mountains in that island, which have an elevation of more than 7,000 feet above the level of the sea; and on these it occurs with the same regularity as many plants."

Noxious as are some species of animals to us, and insignificant as many of the inferior tribes may appear, they all act their appointed part in the economy of nature, fulfilling the offices assigned them by the Creator. Man is apt to regard good and evil so entirely as it has reference to himself, and is subservient to his own convenience, that he not unfrequently overlooks the general amount of happiness which the beneficent

Author of Nature appears to have had in view in the creation of animated beings. He too much considers the world as made for him, and for him alone; and accordingly too often regards all things that are not conducive to his pleasure or benefit, either as useless or noxious. "We complain," says Paley, "of what appears to us the exorbitant number of some troublesome insects; not reflecting that large portions of nature would be left void without it. What we term blights, are oftentimes legions of animated beings, claiming their portion of the bounty of nature."

In the animal, as well as in the vegetable kingdom, the largest proportion of species occurs in the warm regions of the globe, and a gradual decrease in the number both of genera and species, is observable as we recede from intertropical countries. This decrease is very striking in the *radiated animals*, the greater number of which are inhabitants of the ocean.

In cold latitudes, the cellariæ, and sertullariæ, with a few sponges, alcyonia, and asteriæ, are alone to be met with. In proceeding towards the equator, when we arrive at the forty-fourth or forty-fifth degree of north latitude, their number increases, and gorgoniæ, sponges with loose tissues, and millipores appear in profusion. A little further and the coral reddens the depths of the ocean with its brilliant branches; Sicily, in particular, having been long famed for its fisheries of the true red coral. This is soon followed by the large madrepores. It is not, however, until we approach the thirty-fourth parallel of latitude that the radiated animals become developed to any great degree in the northern hemisphere; and it is chiefly within the tropics, that these minute animals, scarcely visible to the naked eye, perform the important offices allotted them in the field of nature; constructing those vast reefs, which either form additions to already existing land, or constitute new islands.

The flustræ, however, do not appear to be restricted by climate, but abound in every sea, occurring in profusion on the sea-shores, being usually found attached to the fuci thrown up

from the depths of the ocean; some of these flustræ appearing like spots of a chalky substance on the sea-weed; whilst others, of a light fawn colour, and spreading-like leaves, might almost be themselves mistaken for sea-weed. The sertullariæ, which also abound on our shores, likewise present arborescent forms, and some species are very beautiful.

Radiated animals are met with in considerable numbers in the Mediterranean Sea, and the sponge of commerce is principally obtained from the Greek islands. But perhaps few parts of the ocean afford the spectacle of a more striking assemblage of these animals, than the bed of the Red Sea; every part being covered both with sub-marine plants, and with various species of polyparia, the whole "presenting the appearance of a submarine garden of the most exquisite verdure, enamelled with animal forms."

There with a light and easy motion
The fan-coral sweeps through the deep clear sea,
And the yellow and scarlet tufts of ocean
Are waving like corn on the upland lea,
And life in rare and beautiful forms
Is sporting amid those bowers of stone.

Animals belonging to the class *Mollusca* are also more numerous in species and more remarkable for their size and beauty, in the hottest regions of the globe, than in cold and temperate latitudes. And when instances occur of similar species inhabiting different zones, we find that the individuals met with in countries nearer the equator, are of larger dimensions than those which are natives of colder climates; generally speaking, however, the species differ, even where the genera agree. Of this, the beautiful volute shells which are dispersed over nearly all the temperate and warm regions of the globe may form an instance. Thus, the voluta olla is found in Spain; the voluta cymbium in Africa; voluta tesselata, and other species, in India; voluta Braziliensis in South America; and voluta umbilicata in Australia. Twenty-four species of shells are, however, known to be common to the European and American coasts of the Atlantic.

The sepia, or cuttle fish, of our shores, are animals of sin-

gular, but not of formidable, aspect. In the Mediterranean Sea they attain a great size: and Mr. Swainson mentions having seen one off the coast of Messina, whose arms were thicker than the wrist of an ordinary man; but the most enormous cuttle-fish are those inhabiting the Indian Seas (fig. 171), where they are of sufficient size to attack the pearl divers, whom they seize and entangle in their "arm-like feet." Among the northern molluscs, one of the most worthy of notice, is the clio (fig. 172), remarkable for the enormous swarms in which it occurs, and from constituting the principal food of the whale. The trepang, *beche de mer*, or sea-slug, is another singular molluscous animal, which appears to be confined to the shores of the Indo-Chinese countries, the Indian Archipelago, and Australia.

The marine shell-fish, or testacea, of Northern Europe, are not distinguished for their variety or splendour; but the Mediterranean Sea, although many of its species are similar to those occurring in the British seas, affords others bearing a strong affinity to the species met with in the Red Sea, on the northern coasts of Africa, and even in the Indian Ocean. The conchology of the Indian Seas is the most splendid, profuse, and varied, of any division of the globe. There we meet with the conus, oliva, voluta, harpa, cyprea, mitra, and many other of the most valued shells. The bivalves, also, though less numerous, include some very remarkable species, such as the malleus, or hammer-shaped oyster; and the tridacna gigas, the largest known bivalve, the shell sometimes measuring four feet in length, and the whole animal being of the enormous weight of five hundred pounds. Africa also ranks among its shells some beautiful cones, volutes, olives, &c. The marine conchology of the West Indies and America is very deficient in species, when compared with that of Asia in similar latitudes. America, however, perhaps exceeds the other divisions of the globe in its fluviatile, or fresh-water shells; and the southern part of the continent contains some very remarkable land-shells of the bulimous kind (fig. 175), which are met with in the forests, and frequently exceed four inches in length. The shells of the Austral Ocean rank next in splendour to those of the Indian seas. The snow-spot

volute, and some other rare species, are peculiar to this region; and the particularly beautiful shells called phasianellæ, or pheasant snails, are principally confined to Australia.

Among the animals of the class *Articulata*, we find some genera, belonging to the family crustacea, very generally diffused. Thus crabs of various species appear to occur in almost every part of the globe. Some articulated animals, such as the spider and the centipedes, or scolopendra (fig. 169), attain a much larger size, and present a far more formidable appearance, in the hottest regions of the globe, than with us; and the most venomous of the class, the scorpion (fig. 170), though it has been met with in southern Italy, yet appears in its most dreaded form in intertropical countries. Among the articulated animals possessing the most general interest, are, however, the insect tribes, and to these we shall accordingly give a rather more lengthened consideration.

Insects, by their number, and the variety of their powers and instincts, exercise great influence in the economy of nature. A small number of species, including the bee, silk-worm, cochineal insect, &c., are of direct utility to man; and a far greater number indirectly promote his benefit. Among the latter are all such as destroy animal and vegetable substances in a state of decomposition; substances which, were they suffered to remain, would taint the air. Such insects, also, as prey on other noxious tribes, and are thus instrumental in keeping them within due bounds, may be considered as indirectly useful. Many other instances might be adduced, but these will suffice us for examples.

Although the stations of insects are less determined than those of plants, and it would be difficult to assign any precise station to some species, yet in taking a general view of the insect tribes, the following division into ten stations, forms a convenient arrangement.

1. *The sea.* A very limited number of species belong to this station; the insects frequenting the waters of the ocean, even in their perfect state, are few in number; and not one species is known which passes all its changes in the sea.

2. *The shores of the sea.* The number of species inhabiting the shores of the sea is far greater, especially in warm countries, which are usually rather rich in species peculiar to this station.

3. *Brackish waters.* Brackish waters have their peculiar species, which ascend the sides of rivers as far as the tide extends.

4. *Fresh water.* Where the preceding species are lost sight of, others make their appearance, and these never quit the vicinity of fresh water. Among the fresh-water species, some only continue in their watery abode in their earlier states, and live there completely immersed; others pass their whole lives in the water. The latter, however, sometimes leave their watery abodes for a short time, usually at the approach of night. Some aquatic insects live only in marshes, ponds, and stagnant pools, whilst others prefer running water. Some insects are peculiar to the margins of fresh water. These again differ with the soil; some choosing a sandy, some a stony, or gravelly, and some a muddy soil.

5. *The various kinds of soil*, according as they are dry or moist, cultivated or uncultivated, rocky, sandy, compact, light, &c., have each their appropriate insects, which either inhabit the surface, or the interior.

6. *Mountains.* The declivities of mountains afford numerous stations for insects. The species which inhabit the more elevated parts are called *alpine;* and those whose range is confined to the lower declivities, are termed *subalpine.*

7. *Living vegetables.* Certain insects seem to delight only in extensive forests, and some species live upon the leaves, and never alight on the earth, except accidentally; others frequent heaths, pathways, and clearings in the wood, without ever resting upon leaves. Some prefer cultivated fields, dry meadows, coppices, or gardens; others, again, are confined to dry salt marshes. Each species is attracted to these different places, not only by the plants which serve it for food, but by certain conditions of heat, light, and humidity. Every part of a plant —its blossom or fruit, its leaves, stalk, root—is liable to be

attacked by particular species of insects, to which this part serves as a station.

8. *Dead, or decomposed vegetables*, form the station of a great multitude of different kinds of insects, especially in their early states.

9. *Living animals* (particularly mammiferous animals and birds) form the station of some insects; and

10. *Dead animals* constitute the station of others.

These stations are not, however, at all times peopled by *perfect insects;* for, although the animals may be found in one or other of their early states of *egg, lava,* or *pupa*, these stations, at certain seasons of the year, present an almost entire solitude as regards the former.

Every species of insect has its determined regular periods for appearing in the perfect form. These periods may be retarded or accelerated by the effect of temperature (as, for instance, by a cold or a warm spring); but these are only slight variations from the general rule; and it may be regarded as an established law, that in all parts of the globe the appearance of insects is intimately connected with that of vegetation.

In our temperate regions, the months of April, May, and June, are the seasons when insects are in the greatest abundance: a remarkable coincidence existing between the appearance of the insect, and the plant which is to afford it food. The number of these animals diminishes in the heat of summer; but in September and October, an augmentation again occurs, which corresponds with the flowering of certain autumnal plants. On the arrival of winter, no inconsiderable number still exist, concealed in their various retreats, and ready to make their appearance on warm and sunny days; whilst a few species continue to frequent our gardens to the close of the year, and some are seen even on the snow itself.

Winter, in our climates, by arresting vegetation, and depriving insects of their means of subsistence, divides the year into two very distinct periods. In equinoctial regions, where winter is unknown, vegetation never being suspended, but where the year is more or less divided into two seasons, the

wet and the dry, the latter season has nearly the same effect on insects that winter has with us—they almost entirely disappear, and are not again visible until the rains commence. When the rainy season is at its full height, it however proves nearly equally destructive to these animals; and these different seasons, at the same time, produce marked effects on the plants which constitute the food of the insect tribes.

The number of different species of insects actually preserved in cabinets, is supposed to amount to at least 80,000; and when we consider the difficulties attending the collection of many species, and the numerous regions still entomologically unexplored, we cannot but conclude that a vast proportion must be still unknown to Europeans*.

The amount of species in any particular region or country depends greatly on its temperature, moisture, and the nature of its vegetation; as also on the absence or presence of barriers (such as a ridge of mountains, or an expanse of water) separating it from neighbouring countries. The general result is similar to that already spoken of with regard to vegetables, namely, that the number of species decreases as we recede from the equator and approach the poles. This will, of course, be subject to local variations, arising from local peculiarities.

The globe has been divided into six entomological regions, according to the profusion or poverty of species:—

1. The first includes tropical America; and of the countries which it contains, Brazil stands pre-eminent, Mexico is the next in order, and after these Guiana and Colombia.

2. The Isles of Sunda, the portion of the Asiatic mainland situated in their vicinity, the Island of Madagascar, Cafraria, and the eastern coasts of intertropical Africa, rank next in profusion of species, and constitute the second region.

3. The third region embraces a large portion of Europe, including also the shores of the basin of the Mediterranean. Among the countries belonging to this region, Germany appears to hold the first rank.

* The *probable* number of species of insects existing on the whole globe has been estimated at from 330,000 to 360,000.

4. North America, which forms the fourth region, seems to be much less prolific in species than Europe in the same latitudes.

5. The fifth region comprehends the arid and sandy districts of the globe, lying within or near the tropics; Northern Africa, Chili, Peru, and perhaps, some of the plains of Asia. Australia may also be included in this region, though the last in order.

6. The sixth region, and the lowest in this comparative scale, is formed by the Polar regions. No true insect has been discovered in Spitzbergen, and even in Novaia Semlia, or Nova Zembla, only ten species are known.

Some insects are very local, whilst others are common to remote countries, separated by apparently almost impassable barriers. The insects of Greenland appear to be identical with our own, but those of the United States differ in species from the European. With a single exception, all the species of insects inhabiting the eastern parts of Asia are distinct from those of Europe and western Asia; this single exception is our well-known painted lady butterfly (*Cynthia cardui*), one of the few insects supposed to be universally dispersed over the whole earth, being found in Europe, Asia, Africa, and America.



Painted Lady Butterfly.

The geographical distribution of *vertebrated animals*, like that of the inferior orders of the animal kingdom, is in great measure dependent on temperature, subject also to local variations; and in many instances, species, and even genera, are confined to particular regions.

And had not Nature's serjeant (that is Order),
Them well disposéd by his busie paine,
And raungéd farre abroad in every border,
They would have causéd much confusion and disorder.

The earth's surface has been variously divided into zoological provinces; but instead of adopting any such divisions, we propose at present to take a concise general view of the natural geographical distribution of the four classes of vertebrated animals,—mammalia, birds, reptiles, and fish. And first

. . . . Shoals
Of fish, that with their fins and shining scales
Glide under the green wave. MILTON.

Our acquaintance with the inhabitants of the ocean is necessarily more limited than with those of the land, and their geographical distribution, cannot, in all cases, be so well determined. It, however, appears, that a great difference occurs in the species inhabiting the coasts of the Old and New World; and although most of the *families* of fish are represented by a greater or smaller number of species in both continents, the species inhabiting the opposite sides of the Atlantic, are not usually found to be identical. Fish which feed on the surface, have generally a greater range than those which seek their food from the ground, for the latter probably rarely wander out of soundings, or approach the mid seas; whilst the former, some of which roam from one side of the Atlantic to the other, or inhabit only the middle of that ocean, belong as much to the New as to the Old World. Some species of fish, however, appear annually to migrate from the deeper and less accessible parts of the ocean*, and approach the shallow shores, for the

* This periodical approach of some fish to shallow water, accounts for the occasional appearance off our coasts of some species, such as the cod and haddock; and a recent author has even attributed the migration of the herring

purpose of depositing their spawn among the marine plants which fringe the coasts.

Perhaps the most universally diffused fish are the perch family, and the salmon and trout family; some species of which appear to have been met with in almost every part of the globe. But in these, as in most other cases, although the families have their representatives, and the genera may frequently agree, the species differ. The *salmo salar* (fig. 165), however, is considered to inhabit both sides of the Atlantic. This family of fish, whilst it occurs in the waters of tropical America, includes also the most northerly of fresh-water fish; and the Alpine trout of Nova Zembla is often caught in immense quantities and exported to distant countries. The sturgeon (fig. 155) is met with in Europe, Asia, and North America, but the species differ in different regions; Western Europe contains only one species, whilst North America, and particularly the River Mississippi and its tributaries, present numerous and varied species. The cod and whiting family occupy the northern parts both of the Atlantic and Pacific Oceans, and some species, among which is the *gadus morrhua*, or common cod (fig. 160), are considered to extend over the whole range. Fish of the sole kind are also met with on both sides of the Atlantic; the identity of species has not, however, been satisfactorily ascertained. The herring family (fig. 164) has a considerable range, similar species, in some instances, apparently extending to both continents. The mackerel makes its appearance periodically on the western coast of Africa, and also in New Zealand, as well as on our own shores; we are not aware whether of similar species. The mullets do not extend their range across the Atlantic, but some species have a considerable range from north to south; thus, one species is met with from Norway to the Mediterranean, and another extends its range from the Brazils to New York. Among fresh-water fish, the only species which is considered unequivocally to occur in both continents is the common pike, though it is rather singular that this fish is unknown to the

to a similar cause, supposing that the fish appear off the coasts, sooner or later, in accordance with the climate; this, however seems to require confirmation.

westward of the Rocky Mountains, where the Old and New World are less distant from each other.

The shark "of horrid jaw" (fig. 153) is very generally diffused over the seas of warmer latitudes, and appears, like most other animals of a ferocious nature, to be larger and more powerful in the hotter regions of the globe than in its more northern range. The sword fish (fig. 154) inhabits the Mediterranean, and perhaps extends its range to the coasts of America. The family of sauroid fishes of the present day, contains only two genera, one of which is peculiar to Africa, and the other to America. The saw fish (fig. 159) is an inhabitant of the Atlantic Ocean, extending its range across the whole expanse of waters. The chetodon family (fig. 158) mostly inhabit the Indian and Polynesian seas, though one species frequents the coasts of Europe, and some species are met with on the coasts of America. The porcupine fish (fig. 161), and the family to which it belongs, are chiefly confined to the warmer seas. The Cape pike fish (fig. 163) is an inhabitant of the coasts of Southern Africa. The family of flying fish (fig. 162) are met with in all tropical seas, in the Atlantic, as well as the Pacific, and extend their range northwards in the former as far as New York, and to equally high latitudes in the latter. The most northern known fish is the *zoarces polaris*, which has been taken within nine degrees of the north pole.

Dr. Richardson mentions that some of the American fish have the power of making a singular noise; several kinds of fish, vulgarly called "grunts," being met with, which possess this faculty in an extraordinary degree. Some of these fish make this remarkable grunting noise whilst in the water, but others seem to make it only when handled. The former sound has been supposed to be connected with the cavernous recesses in the skulls of the fish which possess this power; and the latter to be occasioned by the sudden escape of a quantity of air from their gills. Dr. Richardson mentions another peculiarity in some fish, occurring off the American coast. "Every mariner," he observes, "who has anchored early in the spring

on the coasts of South Carolina, Georgia, or Florida, must have been annoyed by a drumming noise, produced in the night, apparently on the bottom of the ship, and loud enough to deprive a stranger of rest. This noise is said to be caused by a fish of about six pounds' weight, beating its tail against the vessel, to relieve itself from the pain caused by multitudes of parasitic worms which infest its body."

Reptiles are divided into two classes, *reptilia* and *amphibia*. The reptilia include the *chelonians*, or tortoises and turtles; the *saurians*, or lizards and crocodiles; and the *ophidians*, or serpents. The *amphibia*, called also *batrachians*, include frogs, toads, salamanders, &c.

The intertropical regions present us with the largest and most venomous of the reptilia; and a gradual diminution in their number, size, and in the virulence of their poison, is observable as we approach the colder latitudes, until at length they totally disappear. Reptiles appear to be more numerous in tropical America than in any other part of the world; and even in North America, they occur in much greater variety and abundance than in Europe. But although the Old World possesses fewer species than the New, reptiles are found to have a more northerly range in that division of the globe than in America. Thus, the most northerly known range of the emys, or fresh-water turtle, in America, does not extend beyond the fiftieth parallel of latitude; but the European emys is found some degrees further north in Prussia. In America, the most northern limit of lizards is also the fiftieth parallel; but it will be evident that they extend considerably further to the north in Europe, for they are by no means uncommon in our own island, and are even met with in Sweden. The serpent tribe swarm in the equatorial districts of America; but disappear on the declivities of the Andes, at the elevation of 6,000 feet above the sea; and their extreme northern limit in that continent, is the fifty-fifth parallel; whilst in Europe a small species of serpent is met with in Norway. This difference in the range of animals of this description, appears to arise from the diversity of climate in Eu-

rope and America; for, though the hot summers of the latter region are favourable to their developement, they are probably not adapted to endure the severe and long-continued winters experienced in the more northern parts of Eastern America.

With the exception of one or two species of sea-turtles, not any animals included in this class appear to be common to both continents. Thus, among the crocodile family, we find the gavial, or garial (fig. 141), peculiar to India; the African crocodile (fig. 144), the largest of the tribe, peculiar to Africa; the North American alligator (fig. 142), to Georgia and the banks of the Mississippi; the West Indian crocodile, to the West Indies and the lowlands of Central America; and the South American alligator, or cayman (fig. 143), to the warm moist regions of South America. The chamæleons (fig. 146) are peculiar to the Old World, being met with in Syria and other parts of Asia, and also in Africa, in some parts of which region almost every shrub is said to be covered with them. The iguanas (fig. 145), on the other hand, are all natives of the New World. Among the serpent tribe, again, we find the same difference of species in the different regions of the globe: the python of India, though nearly allied to the boa constrictor (fig. 149) of America, being a distinct species; whilst the cobra di capello, or hooded snake (fig. 152), is peculiar to Asia; the cerastes (fig. 151), to Africa and the adjacent parts of Arabia; and the rattle-snake (fig. 150), to America.

The *amphibia*, or frogs, toads, salamanders, &c., are more capable of enduring the extremes of temperature, than the true reptilia; and accordingly their range is greater, and although they are largest and most numerous in the warm regions of the earth, they also exist in high and cold latitudes. Thus frogs and salamanders are met with on the River Mackenzie, in the sixty-seventh parallel of latitude, where the mean annual temperature is not above seven or eight degrees of Fahrenheit; and where, in winter, the cold sometimes descends to ninety degrees below the freezing point, or fifty-eight below zero; and in other parts of North America, the pools of melting snow swarm with very noisy frogs long before the soil is thawed.

No animal of this class appears to exist in Nova Zembla, a circumstance probably attributable rather to the deficiency of summer heat, and the absence of suitable food, than to the severity of the climate. The genera of frogs, toads, and salamanders, are generally diffused both in the Old and New World, but the genus siren appears to be peculiar to America; though a near approach to it is considered to exist in the singular animal called the *proteus anguinus*, which inhabits some of the lakes of Carniola.

> Come, all ye feathery people of mid-air,
> Who sleep on rocks, or on the mountain summits
> Lie down with the wild winds, and ye, who build
> Your homes amidst green leaves by grottoes cool;
> And ye, who on the flat sands hoard your eggs
> For suns to ripen, come! PROCTER

Birds, like all other orders of animals, have their natural geographical limits; and although much general correspondence of form is observable in parallel zones, both among aquatic and terrestrial birds, yet, in some instances, we find whole families confined to particular regions. Thus, the humming birds are peculiar to the New World, whilst the scarcely larger and equally beautiful sun birds, belong to Africa; and the birds of Paradise are confined to New Guinea, and some of the adjacent islands. In other instances, we find families of birds very widely diffused, but the genera differing in different regions. Thus, the African ostrich is confined to that region, the rhea Americana, or American ostrich, to South America, and the emu to Australia. The *columbidæ*, or pigeon family, are spread generally over the world, some species having been met with in almost every land that has been visited by Europeans; but this family contains several well marked minor geographical groups, and the species are very numerous. The grouse family is likewise widely diffused, though chiefly in the cold and temperate regions; and among these, three species of ptarmigan, which inhabit the most northern districts, are common to both the Old and New World.

The ptarmigans are, however, by no means the only species

of birds common to both continents, for a great similarity exists between the ornithology of Europe, and that of North America, not only in genera, but in species; a third part of the North American species being also inhabitants of Europe. "As the food of the raptorial order of birds" (eagles, vultures, falcons, owls, &c.), observes Dr. Richardson, "must be everywhere very similar in quality, it excites no surprise when we discover that many species are common to different quarters of the world, especially among those groups which prey on quadrupeds and birds, taking them alive. But we are led to expect that the distribution of birds which feed on the fruits of the earth should be influenced in a greater degree by climate, soil, and consequent fertility of the land; and as temperature, moisture, and richness of vegetation have a manifest connexion with the abundance and variety of insects, we look to find the insectivorous birds of the several continents nearly as different as their floras." These remarks of Dr. Richardson are confirmed by his researches; for it appears that, among the land birds of the Old and New World, by far the greatest number of identical species occur among the rapacious tribes. Thus, we find a large proportion of the owls and falcons common to both continents; some of the latter, indeed, appear to be inhabitants of the whole globe. With the vultures, however, the case is different; no species being common to the Old and New World; and the range of the vulture tribe is by no means so extended as that of the owls and falcons, vultures being most numerous in the tropical regions. "Indeed," says Dr. Richardson, "as their food is carrion, their utility in the economy of nature is obviously greatest in the warmer latitudes, where they accordingly abound." The most northerly range of the vulture in Europe, is the fifty-first degree of latitude, though a species of vulture has been occasionally seen in England; in America, these birds reach the fifty-fourth parallel. The magpies and carrion-crows of Europe and America appear to be identical species: and the raven is common to Europe, Asia, Africa, and America. But it is among the wading and swimming birds, such as the cranes,

coots, &c., and the swans, geese, &c., that we meet the greatest number of species common to both continents; and indeed our well-known wild goose is said to extend its range in America, from Hudson's Bay to South Carolina; and in the Old World, to be met with from Lapland to the Cape of Good Hope, and to be frequent in Arabia, Persia, China, and Japan.

Our special little favourite, the redbreast,

> The Thomas in Finland,
> And Russia far inland;
> The Peter of Norway boors;
> Our little English Robin;

appears to be common to every part of Europe, from Spitzbergen to the Mediterranean Sea. It is also found in the woods of North America; but whether an aboriginal native of those regions, or introduced by the settlers, may be doubtful. The common sparrow is very generally diffused over the northern hemisphere; but it is said to have followed the progress of cultivation and the introduction of corn into Russia. The chimney, or barn-swallow, occurs both in the Old and New World; and the well-known cuckoo is common to Europe, and to the highlands of Central Asia, where its familiar note has cheered many a distant traveller, and recalled home to his imagination. The migratory habits of the cuckoo, as well as those of many other species, such as the swallow, black-cap, &c., greatly extend their range of latitude, though not of climate, for the wonderful instinct by which they are guided, and their powers of locomotion, enable them to enjoy a perpetual summer. In all cases, however, these migrations do not appear to be regulated by change of temperature, and the failure of food; but to be dictated by the yet more remarkable instinct with which they are endowed, and which leads them to seek some particular kind of nutriment for rearing their young.

Mammiferous quadrupeds also occur in the greatest number and variety in the hottest regions of the globe, and a gradual decrease in their numbers takes place as we recede from the

torrid zone. Many of the quadrupeds of intertropical region are likewise distinguished for their size, for their amazing strength, or for the ferocity of their dispositions. Like all other classes of animals, the terrestrial mammalia of the Old and New World differ considerably. Thus the apes and baboons (figs. 1, 2, 5), the lion (fig. 11), the tiger (fig. 13), the elephant (figs. 66, 67), hippopotamus (fig. 68), rhinoceros (figs. 69, 70), horse (fig. 77), ass (fig. 78), camel (figs. 80, 81), giraffe (fig. 83), buffalo (fig. 96), and numerous other genera of mammalia, belong exclusively to the Old World; and when America was first explored, its quadrupeds were found to be dissimilar to those previously known to its discoverers; and their surprise and admiration were excited by the new forms presented to their eyes. Such were the puma, or cougar (fig. 12), the jaguar (fig. 14), the capybara (fig. 57), sloth (fig. 58), armadillo (fig. 59), ant-eater (fig. 61), the tapir (fig. 71)*, peccari (fig. 73), and the llama (fig. 82). Another most singular assemblage of animals presented itself to the discoverers of Australia, even more peculiar to that particular region, and generally speaking, differing widely from the fauna of any other portion of the globe. The islands of the Indian Archipelago, usually contain species similar or nearly allied to those found in India, China, or the Indo-Chinese provinces. The whole Polynesian Archipelago, on the other hand, is almost destitute of terrestrial mammalia,

The class Mammalia is divided into nine orders:—1. bimana; 2. quadrumana; 3. carnivora; 4. rodentia; 5. edentata; 6. marsupiata; 7. pachydermata; 8. ruminantia; 9. cetacea.

The order *Quadrumana* includes all animals whose hinder extremities are furnished with hands instead of feet, such as apes (figs 1, 2), baboons (fig. 5), monkeys (figs. 3, 4), macaucos, or lemurs (fig, 6), &c. Quadrumanous animals inhabit chiefly the forests of tropical countries, where they are very numerous; one species extends into Europe, a small monkey

* The Malay tapir was unknown in Europe, until a much more recent period.

being found in the neighbourhood of Gibraltar; this is however, where

"Europe and Afric on each other gaze."

The apes and baboons, as has just been remarked, are peculiar to the Old World; and we find the hapales (fig. 4), and other American quadrumana, distinguished from those of the Old World by a remarkably broad and flat nose, and by the absence, or inefficient smallness, of the thumb of the fore-hand. The sapajous, and some other species which inhabit the New World, have, however this deficiency compensated by the addition of a *prehensile* tail, by which these animals are enabled to cling to the branches of the lofty trees of the South American forests; their four hands, at the same time, being still at liberty for other purposes, so that their tail almost performs the part of a fifth limb.

The order *Carnivora*, or *carnivorous animals*, which includes all the mammalia that subsist wholly or partly on animal food, is subdivided into three *families*:—1. *cheiroptera*; 2. *insectivora*; and 3. *carnivora*. The *cheiroptera* are distinguished by a fold of skin connecting the sides of the neck with all the limbs, and with the fingers of the anterior pair. This family includes bats, and flying-cats. Some species of bats are very extensively diffused, but others have a very limited range. The roussettes (fig. 8), which inhabit the Indian Archipelago and Madagascar, feed chiefly on fruits: whilst the vampires, or blood-sucking bats (fig. 7), are all peculiar to the hot regions of America. The flying-cats, or (as they are sometimes called) flying-foxes (fig. 9), are confined to the islands of the Indian Ocean. These very singular creatures are the only mammiferous animals met with in the Moldivas, where they are very numerous and large, being about the size of a full-grown cat, and may be seen flying about all day long. They are said to be very destructive to the small cocoa-nuts.

The *insectivora*, or carnivorous animals feeding on insects, include the hedgehogs, shrews, and moles (fig. 10). The animals of this family are more than usually restricted within narrow geographical limits; and the North American species

differ greatly from those of Europe. Some are also met with in the East Indies, in Madagascar, and at the Cape of Good Hope, but South America is singularly deficient in animals of this family.

The *carnivora*, or carnivorous animals more especially distinguished by that appellation, include lions, tigers, dogs, wolves, foxes, weasels, bears, badgers, seals, the walrus, &c. This family is subdivided into three tribes:—1. the *plantigrada*, or animals which walk on the entire soles of their feet, such as bears; 2. *digitigrada*, or animals which walk on the end of their toes, such as the lion; 3. *amphibia*, or animals having their feet furnished with webs, which adapt them for an aquatic life.

Among the plantigrada are bears (figs. 27, 28, 29, 30), badgers, and gluttons (fig. 31). The *ursine*, or bear kind, which are generally animals of a surly and savage disposition, inhabit both the Old and New World; and though the species differ, the genera mostly agree. The maritime or polar bear, is however, common to all the northern regions of the globe, traversing the whole of the icy seas from Nova Zembla and Spitzbergen to Greenland, and from thence along Arctic America to the shores of Siberia. This animal has the most northern range of any quadruped, and has been seen by Sir Edward Parry in lat. 82°, but it descends on the Labrador coast as far south as lat. 58°. The glutton, considered identical with the wolverine of America, inhabits the more northern regions of both continents, ranking in this respect next to the polar bear and the Arctic fox.

Animals of the digitigrada tribe are again subdivided into the *vermiform* (so called from their elongated form), the *canine*, and the *feline*. The *vermiform* comprehend weasels (figs. 35, 36, 37), civets (fig. 38), ichneumons (fig. 39), &c. The weasel kind including the ermine, sable, &c., are mostly inhabitants of the more northern districts of both continents; whilst the civets, genetts, and ichneumons, are natives of the warmer regions of the Old World. The second division includes jackalls (fig. 26), wolves (fig, 23), foxes (fig. 25), and dogs (fig. 24). The wolves

of America are distinct from those of the Old World; but a general likeness prevails in the physiognomy of each group, however the species may differ in size, colour, or habits. Foxes are very generally diffused, some species being peculiar to the Old World, and some to the New. The Arctic fox, though an inhabitant of Europe, extends its range, like the polar bear, into the new World, frequenting the Arctic coasts of America as far as Mackenzie's river; whilst another equally northern species, the isatis, is said to be an inhabitant of the western districts of North America and to extend into Siberia. The dog, of which there are innumerable varieties, appears to be a native of the northern temperate zone.

Animals of the feline kind are very generally spread over both the Old and New World, though, with the exception of the pee-shew, which is an inhabitant of the northern parts of both continents, all the species differ. The largest and most ferocious animals of the feline kind inhabit the hottest regions of the earth. And although the geographical range of the lion and tiger, on each side of the equator is considerable, these animals attain a far greater size near that line, than they do at their utmost northern and southern limits. Africa is the abode of the royal lion; the species which inhabits India, and some other parts of Asia, being smaller, and nearly destitute of a mane. The tiger (fig. 13) is peculiar to Asia, being more especially abundant in India, and in some of the Asiatic islands. It however extends its range as far as Chinese Tartary; and a smaller species, or probably variety, is mentioned by Tournefort as inhabiting Mount Ararat, the sides of which it ascends almost to the verge of the snow-line. Africa is the country of the leopard (fig. 16) and panther, which are very numerous in that division of the globe; where we also meet with the hyæna (fig. 21) in considerable abundance. The leopard and panther, however, and some of the hyænas, extend their range into Asia, in which region we also meet with the chetah, or hunting leopard (fig 17), and several smaller animals of the feline tribe.

Not any of the animals we have now enumerated are found in the New World, but animals of the lynx kind (figs. 18, 19,

20), though of distinct species, occur in both continents. America, however, is not without its appropriate feline inhabitants, the puma, or cougar (fig. 12), being peculiar to that continent. This animal which is common to both North and South America, is not unfrequently erroneously called the American lion, though in fact it bears little resemblance to that animal. The jaguar (fig. 14), also peculiar to the New World, is equally erroneously, and even more generally, designated as the panther, an animal unknown in that continent*. The ocelot, or catamountain (fig. 15), is another South American species, and extends its range northwards into Mexico. Wild cats of different species occur in almost every region of the globe, nor are the northern parts of our own island untenanted by animals of this description.

Among the family of *amphibia*, or amphibious animals, are the various species of seals (figs. 40. 41, 42, 43), and the walrus (fig. 44). These animals chiefly inhabit the cold regions of the globe, and the Greenland seals appear to extend their range along the whole of the arctic coasts both of the Old and New World. Some species, however, are met with in more southern latitudes, two or three species being found in Scotland and Ireland; and seals descend to a more southern parallel of latitude on the eastern coast of America, than in western Europe. The walrus is found in all the arctic seas, and descends on the coast of North America to the 47th parallel of latitude. The Southern Ocean has also its peculiar species, among which are the ursine seal, the fur seal, and the elephant seal.

The order *Rodentia* includes the beaver (fig. 49), hare, squirrel (fig. 52), mouse, rat, porcupine (fig. 59), &c. The rodent animals are mostly timid creatures, and, except in extreme necessity, subsist by gnawing vegetable substances. North America exceeds the other division of the globe in the number of different species of animals belonging to this order; but with the exception of the spotted cavy, scarcely an instance occurs of

* This erroneous designation is said to have originated in a mistake of Buffon, who calls this animal a panther, but it appears that he described it from an ocelot, of which he considered it a larger species.

one species being common to North and South America. The rodent animals of the Old World generally differ from those of the New, but the common mouse appears to be spread all over Europe and North America; and rats have been found in almost every land, whether continent or island, that has been explored; though probably in many instances these animals may have been undesignedly spread by the agency of man, and conveyed to such parts in ships, or canoes, a circumstance which is considered evidently to have led to their introduction into America. The beaver, though now extinct in Britain, is met with on the banks of the Rhone, the Rhine, and other European rivers, and extends northwards into Scandinavia. In America its range reaches from the most northern woods, to the 48th parallel of latitude. On the western side of that continent it descends to the 38th parallel. Hares of various species appear to be very widely diffused both in the Old and New World. The principal abode of the common porcupine appears to be in the warm regions of Asia; North America however possesses a species which has a much more northern range. The South American species (fig. 55*) totally differs in appearance from the well-known species, the quills being very little raised, and the animal furnished with a prehensile tail. This is not the only instance of an American rodent animal possessing a prehensile tail; the capromys, a native of the island of Cuba, having a similar appendage.

The order *Edentata*, includes the sloth (fig. 58), ant-eater (fig. 69), armadillo (fig. 59), chlamyphorus (fig. 60), manis (fig. 62), and orycteropus (fig. 63). Nearly the whole of the animals composing this order are natives of South America. The manis, or pangolin (fig. 62), however, inhabits India, and the orycteropus, or Cape ant-eater (fig 63), is a native of Africa.

The order *Marsupiata* includes the kangaroos (fig. 45), opossums (figs. 47, 48), and that singular animal the platypus or ornithorynchus (fig. 64), as well as the echidna (fig. 65). By far the greater number of animals belonging to this order are inhabitants of Australia; although one species, the pha-

langer, is found in the Moluccas, and America possesses two species of opossum, called the didelphys, distinguished from the Australian opossums in being provided with a prehensile tail; a peculiarity, it will be observed, common to several American species of various orders. The opossums are carnivorous animals, but the kangaroos live exclusively on vegetable food; and in Australia, the presence of the latter animals is usually indicative of the vicinity of water and good pasture land.

The order *Pachydermata* is remarkable for the magnitude of some of the animals it includes; and also for the nearly total absence of species occurring in the New World*. Animals of the order pachydermata are for the most part inhabitants of the warm or temperate regions of the globe. Among their number we find the elephant (figs. 66, 67), rhinoceros (figs. 69, 70), hippopotamus (fig. 68), hog (fig. 74), horse (fig. 77), zebra (fig. 79), &c. All these are confined to the Old World; though the Indian and African elephants are distinct species; and not only do the rhinoceroses of Asia and Africa differ, but even the species of Northern and Southern Africa are distinct; the one-horned being found in the Northern parts, and the two-horned and the white rhinoceros being met with in Southern Africa. The hippopotamus appears to be peculiar to the rivers of Africa. The two genera of the order pachydermata which are indigenous to America, are the tapir (fig. 71), and the peccari (fig. 73). The former, differing however in species, occurs in Sumatra (fig. 72). The wild boar, similar in species to that anciently an inhabitant of Great Britain, appears to occur in Africa, and to extend its range across the whole of the Old Continent; though in China it has probably long been extirpated, and given place to the domestic variety, for which that country is celebrated. The waart-hog, or engallo (fig. 75), is a distinct species, peculiar to Africa. The peccari is peculiar to the New World, where the

* The vast proportion of animals belonging to this order, found among the extinct genera and species of the Tertiary Period, will be remembered by those who have accompanied us in our *Recreations in Geology*.

hog was unknown, until introduced by the Spaniards, towards the end of the fifteenth century; but these animals have run wild, and formed large herds, both in North and South America.

The numerous troops of horses which now inhabit the New World, are also considered to be of European origin. This

. . . . . . Noblest of the train
That wait on man, the flight-performing horse,

appears, in the earliest historic periods, to have been very generally diffused over the Old World. We learn, from the Book of Genesis, that horses were employed in chariots, and also for equestrian purposes, by the Egyptians, in the time of the patriarch Joseph: and we also find, at a later period, that King Solomon obtained horses from Egypt, which has been called "the central and original riding school of the whole world." Horses evidently existed in a wild state at a very early period in the land of Edom; and in the time of the prophetess Deborah, they formed part of the host of Jabin, king of Canaan. "Herodotus," says Cuvier, "informs us, that horses existed in a wild state on the banks of the Hypanis (now the Dniester). Strabo says, that wild horses were found in India, on the Alps, in Iberia, among the Celts, and finally on Caucasus." And, according to more modern accounts, it appears that wild horses are still to be met with in Western Tartary, and in the Russian steppes. This valuable and beautiful animal seems, however, to arrive at its full perfection in the warm and temperate regions of the earth, and to degenerate in cold climates. The dziggtai, or wild horse of Mongolia, is a totally distinct species.

The ass (fig. 78) appears also to be a native of the warm and temperate regions of the Old World, and the Syrian varieties greatly surpass in size and beauty those with which we are familiar *.

* The ass appears to be unknown in Russia. Captain (now Sir James) Alexander, when on the frontiers of Russia, was called out by some Russian officers to see what they termed a most strange animal; he went out expecting something very marvellous, when to his great surprise, he beheld an ass tied to a tree.

The order *Ruminantia* includes all animals which chew the cud, such as the cow, sheep, deer, &c. Two species of ruminant animals are common to the New and Old World; and in this instance, as well as in others which have fallen under our notice, these are the two species which have the most northerly range—the elk and the rein-deer. The mountain sheep of North America is also supposed to be identical with the argali of Siberia. Animals of the cow kind are very generally diffused over the globe; with the exception, however, of South America and Australia, neither of which possess any native species. The progress of cultivation has caused a total change, both in Europe and other parts, in the distribution of animals belonging to this genus, though it appears that, within the historical period, the vast swampy forests of Middle Europe and Asia abounded in the zubr, or urus (fig. 95); but this animal is now almost exterminated, though still met with in Lithuania, and perhaps some parts of Asia. The arnee, or humped buffalo, inhabits the woods and swamps of India; the zebu, or common buffalo (fig. 96*), being of the same species, to which, indeed, our domestic races are considered to belong. The yak, or grunting ox (fig. 99), inhabits the highlands of Central Asia. The Cape buffalo (fig. 96), remarkable for its spreading horns, is a native of Southern Africa; and the bison (fig. 97), and musk ox (fig. 98), are inhabitants of North America.

The elevated parts of Central Asia appear to have been the original habitation of some of the finest fleece-bearing animals; and at the present day, the Tibet sheep and goats are surpassed by none in the value of their fleeces. Asia possesses a variety of sheep remarkable for its broad tail; and the same species also occurs in Africa; in the latter division of the globe, we meet with many other varieties, among which one of the most remarkable is the Angola sheep. Europe contains numerous races; but the most remarkable is, perhaps, the Wallachian sheep (fig. 102). This species is considered identical with one still met with in a wild state, in Candia, or Crete. In the same island, as well as in Sardinia, another species, called the

musmon, also occurs in a wild state. In North America, we meet with a species which inhabits the Rocky Mountains, hence called the Rocky Mountain sheep (fig. 103). The goat family occurs in all the three divisions of the Old World, and one species is known in North America. Among the animals of this family, the most remarkable are the ibex (fig. 100), and the Tibet goat, (fig. 101). The giraffe (fig. 83) is peculiar to Africa; and the llama family (fig. 82) is confined to South America. Nearly seventy species of antelopes have been described, and of these fifty are peculiar to Africa, besides two or three additional species which are common to Africa and Asia; twelve are considered peculiar to Asia; two species, including the chamois (fig. 88), and sasin, or common antelope (fig. 89), inhabit Europe; and only one species has been observed in America.

The order *Cetacea* includes the whale, dolphin, dugong, porpoise, &c. As these animals traverse the depths of the ocean in pursuit of their prey, the order of their geographical distribution will differ from that of terrestrial animals, and be determined rather by the ocean they inhabit, than by the shores they occasionally frequent. Animals of this order are, however, imperfectly known, though it appears that ten species of true cetacea have been observed on the eastern shores of America, all of which probably extend their range to the shores of Europe. Among these are the Greenland whale, dolphin, grampus, narwhal, &c. These inhabitants of the northern ocean occasionally descend to lower latitudes, and our own shores are not unfrequently visited by various species; whilst the porpoise extends its range all round our coasts. The tropical regions of the Atlantic afford us a species of cetacea in the lamantin, or manati, which inhabits the shores both of Africa and America, and is a herbivorous animal. The Northern Pacific presents us with its peculiar species, among which is the rytina (fig. 104,) a herbivorous species, which frequents the shores of Kamtchatka and of North-Western America; and the dugong (fig. 105) is found in the warmer regions of the same ocean; whilst the Southern Ocean again

has its appropriate species, some of which extend their range to the shores of Tierra del Fuego, or to those of Australia.

It may appear that, in our consideration of the geographical distribution of terrestrial mammalia, comparatively little mention has been made of islands; but it will be found that islands situated at a distance from any continent, are mostly destitute of land mammalia, with the exception of such as have been conveyed thither by the instrumentality of man; and islands which are contiguous to a continent, usually contain animals similar to the mainland, and may be considered as included in its general description.

It would be highly interesting, as well as illustrative of the wisdom and goodness of the Creator, to enter at large into some consideration of the remarkable adaptation of each species to its natural condition. This, however, we cannot at present attempt; and must content ourselves with the general remark, that the more the subject is investigated, the more convincing proofs do we obtain, that all God's creatures are designedly and remarkably fitted for the stations in which they are placed. "Animals the most uncouth are in every respect adapted to their condition," says Sir Charles Bell; and it is a "mistaken compassion which is felt for creatures of a peculiar form." Some acquaintance with the habits, as well as the anatomical structure of animals, is, however, requisite to render this apparent; and it is solely by such means that the beauty and excellence of the whole system can be unfolded to our view. To mention only one or two examples:—deer, hares and other animals, designed to seek safety in flight, have limbs formed expressly for speed; whilst those of the elephant are formed for strength, and adapted to support the enormous weight of his body. The chamois and ibex, which dwell among mountains, as well as others of the same tribes, which are rapid in their motions, possess the power of discerning objects at a great distance; whilst heavy and slow animals, such as the rhinoceros and hog, whose natural habitation is in valleys are near-sighted. Animals of the torrid zone, such as the Barbary dog, and the apes, are supplied with a very slight coat of

hair; but the animals of the Arctic regions, such as the sable, ermine, bear, &c., are provided with the thickest furs.

If by accident, or by the agency of man, an animal be removed to a station for which in its natural condition it is unfitted, the creature will either perish absolutely, or its original constitution will be modified to suit its new habitation. Thus, the different kinds of dogs, of horses, of sheep, are all varieties of the same species, produced by merely accidental causes, such as domestication, climate, &c. As an instance we may mention that the fleece of the sheep is liable to variations according to the temperature of the region in which it is placed; and, in warmer regions the wool is usually replaced by hair. The sheep originally transported into the New World, was a variety with coarse rough wool. A remarkable change is observable in the fleece of the race (descended from these sheep) which now inhabits some of the warm valleys of South America. The lambs possess this woolly fleece, but if left unshorn, this coarse wool falls off, and leaves a short glossy, and compact hair. In some parts of the same region, the cows, also, instead of having rough hair, similar to that of the horned cattle of temperate zones, have their skins as bare as that of a Barbary dog.

It will be evident that the radiata division of animals rank the lowest, and the vertebrata, but more especially the mammalia, rank the highest in the scale of animated beings. At the head of the latter, and, indeed, of the vast system of organised creation, stands the order *Bimana*, containing, however, only one genus, one species—MAN: forming a remarkable link in—

> The mighty chain of beings, lessening down
> From Infinite Perfection, to the brink
> Of dreary nothing.

The extent of this vast system has been greatly displayed by the study of fossil organic remains; extinct species having, in many instances, supplied links apparently wanting in the chain, before these discoveries were made. As an illustration of this "lessening down," we may mention, that throughout the entire orders of mammalia, a gradual departure from the form

of man is observable. Thus, the hand of man may be recognised in the ape; whilst, in some of the American monkeys, the thumb is almost wanting. In the macaucos, the hand begins to appear deformed, and continues to deteriorate through the hedgehogs, the moles, and the bears. It becomes a paw when we arrive at the dog. Afterwards, in the sloth, the nails exhibit the transition to the solid hoofs of the sheep, stag, and ox, and terminate in the uniform hoof of the horse. Finally, we find in the whales and dolphins, no other vestige of a hand or arm than a stump, rudely fashioned as an oar. Yet, on investigation, the principal bones of the hand and arm are found, though in a rudimentary form; strongly marking the wideness of their separation from the perfectly developed hand of man.

CHAPTER IX.

GEOGRAPHICAL DISTRIBUTION OF MAN.

Our two first parents, then the only two
Of all mankind. *Paradise Lost.*

The world was all before them, where to choose
Their place of rest, and Providence their guide.—*Ibid.*

THE geographical distribution of man over the surface of the globe claims our next consideration. This, however, totally differs in character from any that has hitherto arrested our attention. Man as we have seen, is a single species; and though there are *varieties* of the human race, the researches of the physiologist and comparative anatomist, confirm the account given to us in the sacred scriptures, that the various tribes of men are of one common origin.

Many naturalists have attempted to classify the human species into several *races*, distinguished from each other by peculiarities in the form, colour, and structure of their bodies. The most generally received system is, that which has been adopted

by Cuvier in his *Règne Animal*, which is regulated by the form of the cranium, and which fixes the number of races at three:—the Caucasian, or white: the Mongolian, or yellow; and the Ethiopian, or black.

The assigned characteristics of the *Caucasian* race (Plate VI. figs. A a) are a fair skin, with colour in the cheeks*; an oval head and expanded forehead; soft hair, varying in colour from black to light brown and flaxen, and waving, or slightly curled; eyes varying from blue to dark brown; nose thin and rather aquiline, or straight; small mouth, and a full and rounded chin, This race is considered to include the Jews, the ancient Assyrians and Babylonians, the Arabs, Phœnicians, and Abyssinians, as well as the Medes, Persians, Affghans, and the higher castes of India; the Greeks, also, and all the civilized European nations. The human intellect is considered to have been most highly developed in the Caucasian race.

The *Mongolian* race (figs. B b) is characterised by a yellow or olive skin; square broad-faced skull, with a low and narrow forehead; black eyes; black hair, coarse, lank, and thin; a broad and flattened face; a wide mouth and thick lips. The Mongolian race is represented in the present day by the nomadic Mongolians and Kalmucks, and by the lower castes of India. as well as by a considerable portion of the inhabitants of the northern regions of Europe and Asia; the Laps, or Laplanders, the Samoieds, Kamtchatdales, &c.

The *Ethiopian*, or *negro* race (figs. C c), is characterised by a black or very dark skin; a narrow and compressed skull; a low and narrow forehead; woolly, crisp, coarse hair, collected into little knots; black eyes; a flat and broad nose, thick lips, (especially the upper lip,) and a small chin. This race is considered to occupy the whole of Africa to the south of the Great Desert.

Those who adopt this classification find, however, certain races which, from the form of their cranium, cannot be included under the head of either of these races. "Neither the *Malays*, nor the *Americans*," says M. Cuvier, "can be clearly referred

* The Indian branch, it will be observed, forms an exception to this characteristic.

to one or other of these three races." And, accordingly, those who follow that distinguished naturalist, have recourse to the introduction of *anomalous races*, amongst which the Malays and Americans are included.

Other authors, again augment the number of varieties of the human species to five, seven, or even ten. Thus Blumenbach (who preceded Cuvier) fixed the number at five; adding to the preceding divisions, the Malay and the American. And, more recently, Dr. Prichard has extended the number to seven; namely, the Caucasians, Mongolians, Negros, Americans, Hottentots, (with which are classed the Bochismans,) Papuans, (or the black and woolly-haired inhabitants of New Guinea, and some neighbouring islands,) and the Alfourous, (or the tawny and straight-haired inhabitants of the same region, with whom are classed the Australians.) And yet more recently, M. Flourens, also adhering to the form of the skull, appears to have established ten distinct forms, or types of human heads adding to those of Dr. Prichard, the Malay and the New Zealandic, and separating the Bochisman from the Hottentot.

The colour of the skin in the human species, which as we have already seen, differs in the Caucasian, Mongolian, and Ethiopian races, might be also considered to constitute a distinguishing mark of its varieties; and from the recent researches of M. Flourens, there appears reason to expect, that future investigations may lead to some such result. That naturalist has discovered that, in the skin of the Ethiopian, or black race, a particular apparatus occurs, under the second epiderm, consisting of a *lamina*, or layer of complicated structure, and which is the seat of the *pigmentum*, or colouring matter of the negro*. M. Flourens has also discovered, that a similar pigmental apparatus of a red hue occurs in the Red or American race, imparting to the skin the red or copper coloured tint, by which that race is distinguished.

* This is stated to form distinct and continuous laminæ, altogether wanting in the white or Caucasian race, and not to be, as supposed by former anatomists, arranged as a network, occurring in all, though coloured only in the black race.

That further investigations may lead to the discovery of a similar apparatus, though of different hue, in the other coloured races of the globe, appears highly probable; and also that, in this number some portion of the Caucasian race will be included, but more particularly the Indian branch. This classification, according to the colour of the skin, may therefore lead to a different arrangement of the varieties of the human species, or at least to subdivisions, which may tend to prove, that remarkable as is this pigmental structure, it can only be considered as an accidental variety.

Another mode of classifying the varieties or races of mankind is by the affinity of languages. This, perhaps, is both the most interesting, and also likely to lead to the most satisfactory results. It appears that the number of human idioms, widely differing from each other, is very great; and according to Dr. Prichard, the probable number of languages spoken over the whole globe, cannot be much under 2,000.

A comparison of various languages, however, shows that many have a family resemblance or relationship, subsisting between them, which is exhibited in the circumstance of a large proportion of their elements, or roots, being common to the whole group, united with a general resemblance in their grammatical structure. Nations whose idioms have this affinity, are considered to be allied in origin. Groups of idioms thus related are termed *families of languages.*

One strongly marked family of languages consists of the dialects, collectively termed the Semitic: (so named from the supposed descent of the nations who speak them, from Shem the son of Noah.) To this family belong the Hebrew, the Aramean, (which includes the Babylonian and the Syriac,) and the Arabic to which the Ethiopic is very closely allied.

Another family of languages is the Indo-European, which includes various idioms of Europe and Asia. This is a most extensive group, and contains six branches, two of which belong to Asia, and four to Europe. 1. The Sanscrit and all its dialects in India. 2. The ancient Zend, or Medo-Persic language as well as the ancient Pehlvi and Devi, and all the idioms now

spoken in Persia and Armenia. 3. The Greek and Latin languages, and all the dialects sprung from them. 4. The Sclavonic, the origin of the Russian, Polish and Bohemian languages. 5. The Teutonic, with the Gothic at its head, and comprising the different German dialects, the Anglo-Saxon, Danish, Swedish, &c. 6. The Celtic, comprising the Welsh, Cornish, Gaelic, Erse, &c. It will be evident, that these two groups, the Semitic and Indo-European, extend over the whole portion of the globe inhabited by the Caucasian variety; and, through European colonists, the European branches have extended to America and other parts of the world.

Another accordance existing between languages is that of *analogy*. Many idioms which are entirely distinct from each other, and have few, or perhaps no words in common, are yet found to bear a striking resemblance to each other in their grammatical structure. Languages bearing this resemblance are not considered as belonging to the same family, but to the same *school* or *class* of languages. Thus, a strongly marked class, are those termed *monosyllabic;* the words belonging to such, consisting of monosyllables. Idioms of this description are spoken by the Chinese, Tibetians, Siamese, and nearly all the Indo-Chinese nations. But the languages of each of these nations, though possessing this agreement of structure, are totally distinct from each other.

Another class of languages are those termed *polysynthetic;* these consist of long polysyllables, refined and elaborate in their construction, and admitting of almost endless changes of termination. To this very remarkable class of languages belong all the idioms of America, from that of the Esquimaux at Behring's Straits, to the dialects of Patagonia and of Tierra del Fuego. And yet, fifteen hundred different dialects are said to be spoken in different parts of that continent, though these are referred by Dr. Prichard to a few great divisions.

"The diversities of language," says Dr. Prichard, "carry us very far back towards the infancy of our race, and are, perhaps, much more ancient than the varieties of form and colour." The question has been asked, Whence has this diversity of lan-

guage arisen? We naturally turn to the dispersion incident on the confusion of tongues, as the era from which this diversity is to be dated; for we are expressly told, that before this "the earth was of one language and of one speech;" but that "the Lord did there confound the language of all the earth*."

It, however, appears, that whatever view physiologists take of the varieties of the human species, whether as distinguished by form, by colour, or by affinity or analogy of languages, all arrive at the same conclusion, which we cannot express better than in the words of M. Flourens: "*Unity*," he observes, "*absolute unity* of the human species, and *variety* of its races, as a final result, is the general and certain conclusion of all the facts acquired concerning the natural history of man."

It has been said, that "man appears to possess a remarkable pliancy of constitution, and to be the only animal fitted by nature to inhabit every possible variety of climate. His animal existence is not less secured in the frozen regions of the arctic circle, or under the burning climate of the equator than in the intermediate countries; and he may be said to be the only true denizen of the old world." There can be no doubt, that this power in the human frame to accommodate itself to different climates is, in some measure, attributable to the natural constitution of man, and to the peculiar conformation of his digestive organs, which are adapted to every variety of food; but this universality of the human race may, perhaps, be more correctly assigned to a far higher cause—his intellectual powers.

Where, may we not inquire, is the man, who, without artificial protection, could withstand the rigour of an Arctic winter? When God "casteth forth His ice as morsels; who is able to stand before His cold?" Inferior animals may, and various species do, by wonderful instinct, collect stores of provisions

* To this commonly received opinion, an objection has been raised, that the dispersion of Noah's family had taken place previous to this period. This objection appears, however, wholly without foundation: for a careful examination of the 10th and 11th chapters of Genesis will show, that the 10th does not record events *antecedent* to those mentioned in the 11th chapter, but that it almost wholly consists of a genealogical register.

against the winter; but man alone learns to guard his own body from the intense cold; man alone learns to kindle a fire; and it is by his own ingenuity, by the prudent choice of means, and by profiting from the experience of those who have preceded him, that man is enabled to become a cosmopolite. Inferior animals, on the other hand, have particular appointed stations, suited to their nature, and to the instincts with which they are endowed. They are incapable of profiting by the experience of their predecessors, nor is it needful that they should; for although we find

Reason progressive,—instinct is complete,

they, "without instruction, are equal to the task assigned to them. In their performances, we often admire the ingenuity of the contrivance, and the complexity of the work: but it is the ingenuity of the species, not of the individual: or rather, it is the wisdom of God, not the deliberate effect of invention or choice. The animal's task is prescribed, and his manner of performing it secured."

The capability of indefinite improvement is one of the distinguishing characteristics of MAN: he is endued with powers of judgment, of generalization, of imagination, with a guiding conscience. And fallen as he is, from the state in which he came out of the hand of his Creator, man is yet immeasurably raised above the brute creation: he belongs to a more exalted order of beings; he possesses a spirit capable of restoration to the Divine image.

Say, why was man so eminently raised
Amid the vast creation? why empowered
Through life and death, to cast his watchful eye
With thought beyond the limit of his frame,
But that the Omnipotent might send him forth,
In sight of angels and immortal minds.

* * * *

Might send him forth, the sovereign good to learn,
To chase each meaner purpose from his breast,
And, through the storms of passion and of sense,
To hold straight on, with constant heart and eye
Still fixed upon his everlasting palm,
The approving smile of Heaven?

CHAPTER X.

GENERAL FEATURES OF THE EARTH.—THE BRITISH ISLES.

. . . . . Through wide Nature's bounds
Expatiate with glad step, and chose at will
Whate'er bright spoils the florid earth contains,
Whate'er the water, or the liquid air. AKENSIDE.

We have now taken a brief survey of the leading principles of Physical Geography, including the general structure of the earth, the phenomena of earthquakes and volcanoes, the arrangement of land and water, the causes of atmospheric changes, and of diversities of climate, and, lastly, the geographical distribution of the animal and vegetable creation, concluding with that of the human species. We have seen that certain laws prevail over the whole earth; we further propose, by way of recreative illustration, rapidly to conduct our readers over the several regions of the globe, and thus to enable them, whilst they "sit at home at ease," without encountering either the risk or the fatigue of extensive travelling, to observe for themselves, to see these laws carried into practice, to trace them in their application to the natural world. And although we may not equal the celerity of Puck, and

. . . . Put a girdle round about the earth
In forty minutes;

our travels will be conducted with considerable rapidity.

. . . . As the bee
From flower to flower, so we from land to land:

and we trust that, like that honey-gathering insect, we also, in our progress, may collect some useful stores. For though we do not suspect our readers of supposing, with certain Hungarians, that Mexico is an English island, or that sugar and coffee grow in Britain, we think it not impossible that we may, whilst more especially directing their attention to the natural distribution of organised beings, and the influence climate and the

variation of the earth's surface exercise on this distribution, at the same time have an opportunity of introducing to their notice some productions of the earth with which they are not familiar, —some fresh instances in which they may trace the providential hand of the Giver of all good.

> . . . . . The venerable name
> Of our adored country, O thou queen,
> Thou delegated deity of earth,
> O dear, dear England! COLERIDGE.

The British Isles form a very minute and apparently insignificant portion of the whole globe; but as to us, who are inhabitants of the soil, they possess a supreme interest, we shall be excused if we pause to take a rather more enlarged survey of our native land, ere we commence our travels across the wide regions of the earth.

If we look at a map of the British Isles, we shall perceive that they extend from the fiftieth to the sixty-first degree of north latitude, and that the extreme breadth comprehends about the same number of degrees of longitude. It cannot, however, fail to strike us, that the length is considerably greater than the breadth, an observation which will be confirmed by actual measurement, for the length from Hermaness to Lizard Point, is about 770 miles, whilst the greatest breadth, from Yarmouth to Dingle Bay, does not exceed 460 miles. We shall, however, readily account for this, when we call to mind that a degree of latitude, which, at a rough estimate, contains seventy miles, is the same, or nearly the same*, in all parts of the earth; but that the degrees of longitude decrease in a regular proportion from the equator to the poles, and that at the parallel of Yarmouth each degree contains only forty-two miles. The following table exhibits the different ratios of the degrees of longitude in various parallels of latitude:—

* The slight increase in the degrees of latitude, as we approach the poles occasioned by the oblate, or flattened form of that part of the globe, is not of sufficient amount to be here taken into consideration.

Latitude.	Miles.
0°	68¾
10°	57½
20°	64½
30°	59½
40°	52½
50°	44
60°	34½
70°	23½
80°	12
90°	0

Although the surface of England is of a diversified character, it does not contain any elevated mountain ranges. Westmoreland, indeed, and part of Northumberland, Cumberland, Lancashire, and Yorkshire, are mountainous; but most of the other counties of England present rather a series of picturesque eminences, than of elevated ridges or peaks; and some of the eastern counties are remarkable for their level surface. This absence of high land, added to its insular situation, renders the climate of the southern part of the island particularly mild. The highest summits in England scarcely exceed 3,000 feet above the sea. The most elevated is—

. . . . The dark brow of the mighty Helvelyn,
Lakes and mountains beneath gleaming misty and wide;
On the right Striden edge round the Red-tarn is bending,
And Catchedicam, its left verge is defending.

Wales is a mountainous country in all its parts, and contains some summits of greater elevation than any in England, though none approaching the limits of perpetual snow; Snowdon, which is the most elevated, not exceeding 3,571 feet above the level of the sea.

The mineral treasures of England and Wales are very great. "Coal, one of the most useful of all the productions of the earth which it has pleased the Almighty to provide for the use of man," is remarkably abundant in our own favoured isle, especially in the western and northern districts, to which, indeed, the *true* coal formation is nearly confined.

Iron, the mineral of greatest importance next to coal, abounds in Staffordshire, Derbyshire, and Wales; it also occurs, in conjunction with coal, in the Forest of Dean, where it is worked to a considerable amount; we likewise meet with this valuable mineral in Surrey and Sussex; and though in smaller quantities, in various other localities. Tin is found in Cornwall, and part of Devonshire. These counties have for ages been celebrated for their supply of this rare and peculiar metal, with which it even supposed that they furnished ancient Tyre. Copper is found in Cornwall, Devonshire, Staffordshire, and Westmoreland and also in Anglesea, and other parts of Wales. Lead occurs in Northumberland, Cumberland, Durham, Derbyshire, Shropshire and Devonshire. Silver occurs in Devonshire, both native (that is pure), and in combination with galena, or sulphuret of lead, the latter yielding thirty-five ounces in the ton; and native silver is also met with in Anglesea. Native gold is found in the refuse of a mine in North Molton, in Devonshire; and the yellow copper of Gold Scoop mine near Keswick, is said to contain much gold. Garnets occur near the latter locality; and also, as well as tourmaline, in Devonshire. The most esteemed graphite or plumbago, in Europe, is obtained from a mine near Seathwaite, in Borrowdale. Petroleum, asphaltum, and elastic mineral pitch, occur in Shropshire and Derbyshire. The former rises to the surface in a bitumen-spring at Coalport; and the latter, called also mineral caoutchouc, from the property it possesses of effacing lead-pencil, is found in the lead mine at Odin in Mamtor. The finest alabaster in the kingdom occurs on the shores of the Bristol Channel, where, between Watchet and Minehead, vast rocks of this elegant substance have been met with. These beautiful cliffs were, however, almost demolished by the severe storms of 1836. Salt that almost indispensable necessary of life, is found in great abundance in this island. The extensive deposit at Northwich, in Cheshire, occurs in beds sixty feet in thickness; and is supposed to be two miles in length, and about three-quarters of a mile in breadth. The annual produce of the Cheshire salt-mines is estimated at fifteen millions of bushels.



The Vale of Glen Coe.

Scotland, in its general outline, consists of two perfectly distinct parts, the Highlands and the Lowlands. The Lowlands comprehend the whole country south of the Friths of Forth and Clyde, likewise extending to the north of the Forth on the eastern coast, through the counties of Fife, Forfar, Kincardine, and Aberdeen, to the borders of the Moray Frith, which, notwithstanding its higher latitude, yet, from its sheltered situation, enjoys as mild a climate as any part of Scotland. A considerable portion of the Lowlands is very hilly, but none of the summits exceed the height of 3,000 feet above the sea. The most remarkable are the "Cheviots grey," celebrated in the annals of border warfare.

Immediately north of the Clyde, the Highland ranges begin to rise. This region "stern and wild," consists wholly of continuous ranges of lofty mountains, which on their southern borders, leave between them some of the fine broad valleys called *straths;* but in the interior, they are only intersected by the rocky intervals called *glens.* One of the most remarkable of these is Glen Coe, which, in terrific grandeur perhaps surpasses every other spot in Great Britain. The bold and broken forms of the surrounding mountains, the abrupt and pointed rocks, and black precipices, all conspire to give it a gloomy but picturesque character, whilst at the bottom of the glen flows the little river Coe, the Conan of Ossian.

The mountains of Scotland, especially the great Grampian barrier, which extends across the counties of Perth and Argyle are so continuous, that they can only be entered by formidable passes. Several of the summits approach the altitude of 4,000 feet, and some exceed that elevation. The most lofty is Ben Macdui, which attains the height of 4,418 feet above the sea level. Ben Nevis is about sixty feet lower. Other summits, of nearly equal elevation, also occur on the borders of Inverness and Ross-shire. These mountains usually dip, almost perpendicularly, into the lakes and seas on which they border; and even the valleys are on so high a level above the sea, that they admit only of the culture of the coarser species of grain, and that in scattered patches. Nor do the lowlands present any extensive

plains, such as are met with in South Britain, for even the Lothians are hemmed in by low ridges of bleak table lands, covered, in a great measure, with heath and moss:

And rich the soil, had purple heath been grain.

The arable lands are almost solely comprised in the broad flat valleys called straths, or carses. It is in a valley of this description that Inverness is situated; and hence, as before mentioned, the culture of wheat extends to that limit.

The Isles of Scotland may be considered as forming a third division of that country. On the east, indeed, and even on great part of the south-western coast, only a few bold and naked rocks rise perpendicularly from the ocean. But the western highlands are bordered by the Clyde Islands and the Hebrides, some of which are separated from the main-land by such narrow channels, that they may almost be considered as forming part of it. Bute, which contains no lofty summits, but which is beautifully varied with hill and dale, possesses the mildest climate of any part of Scotland. Arran is remarkable for its magnificent and imposing scenery, and for the interesting geological phenomena it exhibits. The Hebrides (with the exception of Isla, once the residence of the "Lords of the Isles," and which is in great part level and fertile) are chiefly characterized by rude rocks and mountains, deep valleys, and large expanses of peat-mosses. Staffa which is scarcely more than a large rock, is celebrated for containing the splendid basaltic formation, called Fingal's Cave. Almost all the rocks of this islet are basaltic and columnar, some being bent and twisted in a remarkable and beautiful manner. Besides Fingal's Cave, two others, called the Cormorant's Cave, and the Boat's Cave, present similar scenes, but with interesting varieties. The climate of these islands is, generally speaking, unfavourable to the growth of trees; and thus it is said of Coll, "that there never was a plant more than three feet high in that island." It, however, yields a profusion of beautiful flowers.

The northern extremity of Scotland is prolonged by the two ranges of the Orkney and Zetland, or Shetland Islands, which, though some distance apart, are arranged in a linear

direction. These islands are not mountainous, but are rocky and bare, and exposed to excessive moisture, and to the violent winds which sweep across the Atlantic Ocean. The "storm-swept Orcades," or Orkneys, are exceedingly irregular in their form; the deep sounds by which they are penetrated, and the narrow straits which separate them from each other, causing a complete intermixture of land and sea. These islands are generally bleak, boggy, and bare. The Zetland Isles, though not, as supposed by the ancients, the Ultima Thule, or remotest boundary of the habitable world, nevertheless form one of the boldest extremities of Europe: surrounded too, as they are by the sea, and unscreenened from the Arctic and Atlantic Oceans, the climate of these islands is cold and bleak, and they are swept by furious winds, and deluged by torrents of rain. The extensive peat mosses, and the trunks of trees found in the peat, prove that a considerable portion of these islands was at one time covered with forests; but the latter have totally disappeared, and the violence of the winds and sea-spray has rendered every attempt to replace them unsuccessful, so that the aspect of the country is now completely bare, scarcely producing a shrub. We cannot, however, but suppose that some change must have occurred in the climate of these islands; and it is not improbable that they were, at no very remote period, of larger extent: for so great is the power of the mighty waves of the Atlantic, that all the islands have become completely intersected with long *lagoons*, or lake-like inlets, termed *voes;* and even in the largest islands there is now scarcely a spot which is two miles distant from the sea. On the western side of these islands, mere clusters of rocks remain in many parts, marking the site of some ancient island, and frequently assuming the most fantastic forms. These clusters are called *drongs,* and appear to be attributable to the different nature of the rocks of which the islands are composed, and to the more rapid disintegration of certain portions, whilst the more durable granite remains.

The mineral treasures of Scotland are not so great as those of England and Wales. It, however, contains some highly important coal fields, though these occupy a comparatively

limited district. These coal fields are in some districts accompanied by a vast deposit of iron ore; and bog iron ore is met with in various parts of Scotland. Magnetic iron ore likewise occurs particularly in the Zetland Isles; it being diffused through the mountain mass of Saxaford Hill, in Fetlar, in sufficient quantity to affect the compass in a remarkable degree. There is a large deposit of lead mixed with silver, in the high range between Lanark and Dumfries-shire. Native copper, and copper ores of various kinds, including malachite, occur; not, however, in sufficient quantities to yield much profit, but affording objects of great interest to the mineralogist, especially in the Orkney and Zetland Islands. Native silver is also met with; and some years since a vein of silver was wrought with considerable advantage at Alva, in Stirlingshire. Silver likewise occurs in Argyleshire; and many of the female peasantry in Lorn, fasten their cloaks with large silver broaches of a circular form, said to be of ancient date, and made from the silver found in the hills, either native, or procured from the lead. Native gold is found at Glen-Turret in Perthshire, and also at Leadhills in Lanarkshire. The gold-mines of Glengonar, in the latter locality, indeed, appear once to have been productive; for, in the reign of James the Fifth of Scotland, 300 men are said to have been employed in these mines. And when that monarch, in a hunting excursion, dined in Crawford Castle, at the termination of the repast he caused to be placed before each of his retainers on wooden platters for dessert, a few coins of gold, as the produce of the soil. These pieces were made from gold obtained in the mines of Glengonar, the rivulet on which Leadhills is now built. The produce at present is very small; but sufficient to form an object of interest to the miners at Leadhills, many of whom amuse themselves during their leisure hours in searching for gold; and on an average, 4*d.* worth of gold may be collected in six hours. Some pieces, however, have been found as large as a pea. Scotland also contains several other valuable minerals; and in some parts we meet with almadine, or precious garnet, ruby, hyacinth, amethyst, topaz, aqua marina, or beryl, cairn gorm, agate or Scotch pebble, rose quartz, precious serpentine, &c.

Ireland is not, on the whole, a mountainous country, the central districts being occupied by one vast plain, crossing the whole island from east to west; its mountain ranges are nevertheless of greater extent than those of England, which they also exceed in elevation. They appear to be detached groups, unconnected with each other: the most elevated summits are in Kerry, which county presents a vast assemblage of wild and rocky mountains, among which Mac Gillicuddy's reeks, or peaks, situated near the beautiful Lake of Killarney, stand pre-eminent, reaching the height of 3416 feet above the level of the sea. Wicklow is also a very mountainous district; and the borders of Leinster are occupied by the long and lofty ranges of Slieve Boom, Knock-mele Down, and Galties; whilst the County of Antrim, at the northern extremity of Ireland, presents a barren range of rocky cliffs, less elevated, but of a bold and peculiar character, including the remarkable and splendid basaltic formation, called the Giant's Causeway. The vast plain which occupies the interior, though it appears nearly level, abounds in hillocks and ridges of limestone; not unfrequently almost bearing the appearance of regular mounds, the work of art. In the hollows formed by these undulations, the vast peat-bogs, which occupy so large a portion of Ireland, are mostly situated.

Ireland contains many deposits of coal; some of which, though hitherto little explored, promise to be of great importance. In Connaught, iron occurs abundantly in conjunction with the coal deposits. Lead is met with in various parts of the island; whilst Ross Island, in the Lake of Killarney, contains a copper-mine; and a peat bog, near Glandore Harbour, in the county of Cork, is quite impregnated with that metal. Native gold has been found in the Ballinvalley streams at Croghan Kushela, in the county of Wicklow. This deposit was accidentally discovered in the year 1796, and the secret having been divulged, nearly the whole population of the neighbourhood flocked to the spot, in quest of the precious metal; and several hundreds of people might be seen daily assembled, digging and searching for gold in the banks and bed

of the stream. The peasantry remained in undisturbed possession of it for nearly six weeks, during which time considerable quantities were collected. At that period Government took the matter in hand; regular steam works were established, and operations carried on with success until the period of the Rebellion in 1798, when the works were destroyed. The mining operations were resumed in 1801; but the return being inadequate to defray the expenses, the working was discontinued. The gold was found in alluvium, and occurred in grains and masses, varying in dimensions from the smallest dust to lumps of a considerable size. One piece weighed twenty, and another eighteen, ounces. No estimate could be made of the quantity of gold gathered by the peasantry; the amount collected by Government did not exceed 950 ounces, valued at about 3,675*l.*

Beautiful crystals are found in some parts of Ireland, especially in the granite of the Morne mountains, near Newry, where fine specimens of topaz and beryl occur.

Flora of the British Isles.—It has already been remarked, that in temperate zones the distribution of plants depends in great measure on the average *summer* temperature, and also on the degree of cold any plant will sustain. The British Isles, surrounded on all sides by the sea, are subject to much rain, and exempt from intensity of heat or cold; and thus, whilst they escape the severe winters experienced in similar latitudes on the Continent, they do not enjoy so much summer heat as continental countries. The consequence of this *insular* climate is, that some European plants requiring a high summer temperature, fail of coming to perfection in these islands; whilst other plants, which will not stand the severe frosts of the Continent, flourish with us. About three thousand three hundred species of plants are now known as natives of the British Isles, to which, however, only a very small number are exclusively confined. And though some of these plants are limited to small districts in these islands, it not unfrequently happens that they are met with in distant regions of the globe. Thus the jointed pipewort, (*eriocaulon septangulare*,) is con-

fined to a few lakes in the Hebrides, and some spots in the south and west of Ireland, being found nowhere else in Europe; but also occurs in Canada; the trifid-leafed cinquefoil, (*potentilla tridentata,*) is found only on one hill in Angus-shire, which is its sole European station; but is abundant in Arctic America, and particularly on the Rocky and White mountains.

Some plants reach their northern limits in the south of England and Ireland. Among these, stands conspicuous the arbutus, or strawberry tree, which flourishes especially in the neighbourhood of the Lake of Killarney, where this beautiful tree attains a great size. The Cornish heath grows nowhere in Britain except Cornwall. As an indigenous plant, the sweet violet scarcely reaches the middle of the kingdom; and Scotch bards, instead of celebrating the deep blue violet, sing of "the violet pale." The northern and Alpine districts, on the other hand, are not wanting in their peculiar indigenous species, whose range does not extend to the south of the island: such are the Scottish primrose, alpine gentian, &c. Some plants, again, are confined to the eastern, and others to the western districts of the island; the plants of the eastern coast having generally the character of those which are natives of dryer and warmer climates. The flora of the country round London is, perhaps, not surpassed throughout the whole of England. Surry is particularly rich in orchideous plants, which also occur plentifully in Kent. They are found, though less frequently, in Essex and Middlesex; but are in great quantities in some parts of Hertfordshire. Kent and Surrey also contain many other rare plants.

Ireland, again, exhibits a few striking peculiarities in some of its vegetable productions. Besides the arbutus, already alluded to, it can boast the large-flowered butterwort, (*pinguicula grandiflora,*) a beautiful flower, also a native of France and the Pyrenees; the graceful menziesia, indigenous both in the latter locality, and in Spain, but found growing wild in no other part of the world; the London pride, or kidney-leaved saxifrage also, which is scarcely known to exist, except in this locality, and in Switzerland and the Pyrenees; the yellow

poppy, a peculiar arctic plant, unknown elsewhere in Europe, but plentiful on the northern extremity of America, and in Greenland, &c. The Irish yew and Irish furze are considered to be peculiar to Ireland; and to these the Irish broom is added by some botanists.

The trees which appear to be aboriginal natives of Britain, are the oak, (two species,) the elm, (five species,) the beech, ash, maple, and sycamore, hornbeam, lime, (three species,) alder, birch, poplar, (four species,) aspen, mountain ash, yew, holly, and pine, or Scotch fir. To these may be added, though of less importance as timber trees, the willow, whitethorn, crab-apple, blackthorn, hazel, guelder-rose, bird-cherry, elder, &c.

In regard to the height above the level of the sea, at which some kinds of plants will thrive, it will be evident that the southern and midland parts of Great Britain do not contain mountains or land of sufficient elevation, to afford any striking illustration of this natural distribution of plants; and if we find some of the elevated lands on the southern coast devoid of trees, it may rather be attributed to their exposure to sea winds, and perhaps want of congenial soil, than to elevation above the sea level. In the north of England, however, the case is different: the mountains there rise to the height of three thousand feet, and an opportunity is afforded of observing the limits of various species.

The finest oaks are met with in the southern districts of Great Britain, especially in Sussex and Kent, the noble oaks of these counties being regarded as the best timber for the use of the navy*. In the north of England, about lat. 55°, the oak still attains a large size in the valleys, but becomes of stunted growth on the hills, at the elevation of sixteen hundred feet; and in Scotland, except in some of the valleys in the south, it generally only forms copse woods. The common elm is not

* The annexed cut is from an original drawing of Sir Philip Sidney's oak, in Penshurst Park, Kent. In this view of the tree, a specimen occurs of the peculiarly formed diverging branches, to which the term knee-timber has been applied; at one period in great request in naval architecture.



British Oak.—Quercus robur.

indigenous north of the Tees, its place being supplied by the wych elm, which skirts the mountains at the elevation of two thousand feet. The beech, which forms vast forests in the south of England, also flourishes in the low sheltered valleys in the north, but does not grow on the hills to the same elevation as the oak. The linden or lime-tree, one species of which appears to be indigenous to the counties bordering on Wales, and another in Lincolnshire, scarcely reaches the northern districts of England. Holly trees are among the chief ornaments of the woods of Northumberland, Cumberland, and Durham; in which counties the yew is also abundant. The birch attains a greater size in the north of England than in the southern counties, almost equalling in appearance the birches of Norway and Sweden. In Scotland it, however, becomes stunted at eleven hundred feet above the sea. It is accompanied by the sycamore-maple and mountain ash. The dwarf willow grows on the summit of the loftiest Cambrian mountains, more than three thousand feet above the sea level. The Pine or Scotch fir is a native of Scotland, but is no longer indigenous, or even capable of successful cultivation in South Britain; though, from the roots and trunks of very large pines discovered in the peat-mosses on the elevated moors in Cumberland, there is reason to suppose that at some former period it was a native of those districts. This tree constitutes noble forests in the mountainous districts of Scotland, filling the valleys, and affording many specimens of trees attaining towering and magnificent dimensions. In some parts it extends to a considerable elevation on the mountains, but in others ceases to be of value beyond the elevation of 1050 feet above the sea.

The cerealia cultivated in Britain consist of wheat, rye, oats, barley, and bigg, or bere, a hardy species of barley. It has before been remarked that wheat will not ripen further north than Inverness, and there, only in valleys near the level of the sea: in the north of England, its successful cultivation extends to about 1000 feet above the level of the sea; whilst oats succeed at about double that elevation; and potatoes may

be cultivated at the same elevation as oats*. In Scotland, in latitude 57°, however, oats will not come to perfection beyond 950 feet, and barley-bigg ceases to flourish beyond 1050 feet above the sea.

Our native fruits are few in number. Among these the principal are the strawberry, raspberry, red and black currant, and gooseberry, all of which are improved by cultivation. The latter fruit appears to arrive at greater perfection in the northern parts of the island, particularly in Aberdeenshire, where gooseberries are said to be peculiarly delicious, far surpassing those of the southern parts of the island. The hazel is indigenous, and grows wild in Scotland, where, in lat. 57°, it ripens its nuts well, at the elevation of five hundred feet above the sea. The apple, pear, medlar, plum, and cherry, are also natives, but require cultivation to render their fruits of any value. All these, with the exception of the medlar, succeed in favourable situations as far north as Inverness. The chesnut is a doubtful native, and only succeeds in the southern parts of the island; to which the vine, fig, mulberry, quince, and walnut are chiefly confined; though they sometimes, under auspicious circumstances, extend to the middle of the kingdom. The period of the introduction of some of the above species is involved in much obscurity; for history informs us that our Saxon ancestors cultivated almonds, figs, and grapes; but the two former appear to have been unknown at a later period, and to have been re-introduced towards the close of the sixteenth century.

Fauna of the British Isles.—The progress of cultivation and civilization, and especially the commercial intercourse of Great Britain with foreign nations, has undoubtedly effected a vast change in the fauna of the British Isles. The number of species which have become extinct may not perhaps be great, being probably confined to the larger animals, such as the bear,

* It is a remarkable circumstance, that when the soil of the moors in this part is ploughed for the first time, and lime applied, white clover comes up in abundance. The same has been observed in North America, when the woods are cleared away, and the ground broken up.



The Scotch Fir.—Pinus sylvestris.

the wolf, and the wild boar. But among the insect tribes, there can be little question that a considerable number have been introduced with the plants which form their station. The dormant state in which insects remain, both in the egg and pupa, or chrysalis state, greatly facilitates their transmission from one region to another; and some species may perhaps have become so naturalized, as almost to be regarded as aboriginal inhabitants. Ten thousand species are now known to inhabit these islands; and it is more than probable that a considerable proportion of these consist of imported species: a supposition which may account for this unusually large number, considering the chilly nature of our climate.

The radiated animals of the British Islands include the sertullariæ, flustræ, actinia, or sea anemone, starfish,

> And those live lucid jellies which the eye
> Delights to trace, as they swim glittering by.

We have few native species of corals; the most remarkable is the May-blossom coral, (*caryophillia ramea,*) which is, however, rare, and apparently confined to the coasts of Cornwall. It is said to retain for many years a slight scent, resembling that of the hawthorn, whence its name. It is common in the Mediterranean.

Our native molluscous animals, though not remarkable for their beauty, are nevertheless numerous, and not devoid of interest. The most valuable, on account of its utility as food for man, is the oyster: the most beautiful perhaps are some of the varieties of the *pecten opercularis,* which are used as food in the west of England. Ireland possesses many species unknown on the coasts of England*. The *isocardia cor,* or heart-cockle, is not unfrequently met with in the Bay of Dublin. Our rivers and ponds abound in freshwater species; among which the most remarkable is the *unio margaritifera,* from which our native pearls are obtained. Little as these pearls are esteemed in the present day, they were included by the Romans among

* Several West-Indian shells, as well as seeds, are frequently found on the coasts of Ireland, apparently carried thither by currents; these, however, cannot be included among its native species.

the productions for which Britain was celebrated. The ancient British pearl fishery was carried on in the Welsh rivers; but the unio margaritifera is at present chiefly found in the rivers of the north of England and of Scotland.

The reptiles of Britain are very few, and in general harmless; the common viper, called also the adder, being the only venomous species. The snakes and the blind-worm are innoxious, and besides these, we only possess two kinds of frogs, two of toads, and a few lizards.

Among our native birds, the golden eagle ranks foremost, being the largest as well as most splendid of the feathered inhabitants of these islands. This bird, though driven from many of its ancient haunts, is still found among the highest of our Welsh and Cumbrian mountains, and also in the Orkneys. The erne, or sea-eagle, is chiefly met with on the steep cliffs which border the ocean in Wales and Scotland. The osprey and falcon are becoming rare. The crane, the egret, and the heron, are also very scarce, though they still frequent some parts of the kingdom. The British owls are similar to those of continental Europe. The principal native song birds of Great Britain, though these are by no means confined to this island, are the blackbird, thrush, linnet, goldfinch, bullfinch, chaffinch, dunnock, or hedge-sparrow, golden crested wren, common wren, robin redbreast, and the lark—

> Ethereal minstrel! pilgrim of the sky!
> Type of the wise, who soar, but never roam,
> True to the kindred points of Heaven and home.

These islands, especially in the southern districts, are, during the summer months, visited by various migratory birds, amongst which the nightingale and black-cap are very conspicuous as song birds; whilst the swallow tribe, from their number and the peculiarity of their habits, form objects of general interest. In the winter months their place is supplied by the field-fares and starlings; and all these birds, as well as the rooks, creepers, titmice, and even the common sparrow, as well as many others, are of great utility in keeping under the swarms of insects, which, but for this check upon their too

great increase, would multiply to so vast an extent, that they would ere long destroy all the fruits of the earth. The stock dove, the cushat dove, ptarmigan, grouse, and partridge, also rank among our native birds. The capercalzie is supposed to have become extinct; and the bustard and quail are very rare. The manner in which birds follow cultivation, is exemplified in some of our British birds. Thus, the cross-bill is said to have followed the introduction of the cultivated apple into England; and the partridge was never known in Glencoe, until the cultivation of corn was introduced in that valley.

The pheasant, now almost naturalized, was originally brought into this country from Asia Minor. Our domestic poultry, as is well known, has been introduced from various parts of the globe: the peacock and common fowl from India; the guinea fowl from Western Africa; and the turkey from North America.

The British mammalia consist of about sixty species, independent of those which have been extirpated from these islands. We have nine species of bats; various species of rats and mice; the hedgehog, which is an innoxious animal, and of great utility in destroying snails; the mole, whose little hillocks, though they disfigure rich pastures, tend greatly to improve poor land; the dormouse; the badger and the otter, which are now becoming rare. The larger carnivorous animals have been nearly exterminated; the only animals of this order now found in Britain, consisting of the fox, wild-cat, and the weasel tribe; among the latter are included the polecat, marten, and stoat. The stoat perhaps forms one of the most striking instances of the variation which takes place in the garb of some animals with a change of climate. That animal, on account of its destructive habits, is regarded in this country as one of the greatest pests of the farmer, and its thin fur, of a yellowish brown colour, being considered of no value, the despised skin may frequently be seen nailed up against the farmer's outbuildings, as a trophy, or a scarecrow. The same species of animal also inhabits various parts of continental Europe; being in the more temperate regions, similar in appearance to our stoat, but,

in its northerly range of Russia, Norway, and especially Siberia, the coat of the animal is transformed into a beautiful thick fur, adapted to protect it from the severity of the climate, of a clear white in every part, except the tip of the tail, which is deep black; and under this form affording the well-known fur called ermine; which name the stoat bears in the northern regions. This animal may occasionally be seen in an intermediate state, between summer and winter clothing.

Our native horses, of which the Welsh and Zetland ponies may be considered as representatives, are small, but esteemed for their activity and strength.

The dogs of Great Britain have been celebrated from remote antiquity; our mastiffs having been in great request with the Romans, who used them in their ferocious combats of wild beasts. The blood-hound was held in high estimation by our ancestors, as a means of tracking their enemies; but the race appears to be extinct. Scotland possesses three species of native dogs: the Scottish greyhound, the Zetland hound, and the colley or true shepherd's dog,—

> There still, of genuine breed, the colly meets,
> Barking shrill-toned, the stranger rarely seen.

The Irish greyhound is a powerful dog, but is nearly extinct.

The list of British ruminating animals is very limited, being confined to the stag, or red deer, the fallow deer, the roe-buck, and the almost exterminated urus, or wild Scottish ox. The excellent varieties of domestic oxen and also of sheep, which have been introduced, amply compensate, however, for any deficiency in this respect. The black-face horned sheep appear to be the most ancient race in our island, and these are still met with in some parts of Yorkshire, and the adjacent counties.

The marine and cetaceous mammalia of Great Britain are not numerous. The principal are the seals, which are inhabitants of the northern parts of this island, and of the western shores of Ireland; and the grampus and porpoise, which have a wider range, being met with in considerable shoals off all our coasts. The whale tribe probably in former times were more abundant than at present. The piked whale, bottle-nosed

whale, and others, are, however, not unfrequently met with in our northern seas, and are occasionally cast on the coasts of the Zetland and Orkney islands, as well as the Hebrides, and the north of Ireland: in some instances, in unfavourable seasons, to the no small relief of the distressed inhabitants. The walrus and the manatus have been seen in Scotland; but perhaps may rather be regarded as visitors than natives.

The wolf, the bear, the beaver, and the wild boar, are extinct in these islands. Wolves existed in Ireland at a comparatively recent period, some having been killed in that country as late as the year 1710; nor were they wholly extirpated from Scotland until the year 1680. It is a commonly received opinion that wolves were totally destroyed in England and Wales in the reign of Edgar. It appears, however, that they cannot have been wholly extirminated at that period; (unless indeed they may have subsequently spread into South Britain from Scotland;) for in the reign of Edward I. we are informed that wolves were in such number, that officers were appointed to effect their complete extermination. Bears probably were anciently very numerous in this island, from whence they were transported to Rome; they also formed objects of chace in Wales. The exact period of their latest existence in Britain is not known, but they are recorded to have infested Scotland in the year 1057. The beaver was an inhabitant of Wales in 1168, though it is supposed at that period to have been confined to the banks of the River Teivi. The wild boar has given place to our domestic races of swine, as the wild ox has to our domestic oxen; but it appears that in the eleventh century, a vast forest occupied the north of London, which was the resort of stags, fallow-deer, and wild boars. Some of the ancient red-coloured swine may, however, still be seen in a half-wild state in the New Forest.

CHAPTER XI.

THE OLD WORLD.—CENTRAL BAND OF MOUNTAINS.—THE PYRENEES.—SPAIN AND PORTUGAL.—FRANCE.—THE MARITIME ALPS.—ITALY.

Like as a ship, that through the ocean wide
Directs her course unto one certaine coste,
Is met of many a counter winde and tyde;
Yet making many a borde and many a bay,
Still winneth way, ne hath her compass lost:
Right so it fares with me in this long way,
Whose course is often stayed, but never is astray.

SPENCER.

THE Old World, including Europe, Asia, and Africa, first claims our attention. A remarkable band of mountains traverses this vast continent from west to east throughout its whole extent, commencing on the shores of the Atlantic, near Fuentarabia, or Fontarabia, in Spain, and terminating on the shores of the Pacific, with the volcanic island of Formosa; the whole length of this mighty band being little less than eight thousand miles, and its breadth varying from five hundred to two thousand miles. Although this range is not altogether continuous, it is sufficiently so for us to regard it as our *central axis*, or *stem*, along which to take our general course, and from which we shall find lateral branches, of greater or less importance, diverging in all parts.

The situation of this vast mountain band, about mid-way between the equator and the north pole, considerable influences the climate of the extensive regions through which it passes; whilst, at the same time, it forms a separation between the warm and fertile countries of Southern Asia, and the less genial northern regions of that portion of the earth. In ancient times, it constituted the boundary-line between the civilized nations and the barbarous tribes of Europe; and although the aspect of these territories is now wholly changed in this respect, it is worthy of remark, that, in its extension through Asia, this mountain band to the present day divides the more civilized

nations of India and Persia, from the uncivilized hordes which still occupy almost the whole extent of the northern regions of Asia, spreading from the borders of China to the Sea of Azof. Indications, however, are not wanting, that some portions of the latter territories were at one period the seat of learning and civilization; perhaps, indeed, that of the earliest on the face of the globe.

In Western Europe, this mountain band commences under the name of the Pyrenees. The scenery in the central part of the Pyrenees is magnificent, presenting the most numerous and concentrated assemblage of elevated summits in Europe.

Chasms of the early world are yawning there,
And rocks are seen, craggy, and vast, and bare,
And many a dizzy precipice sublime.

The highest peaks are Maladetta and Mont Perdu. The deepest valley in Europe, said to be no less than three thousand one hundred feet in depth, is that of Adessa, near Mont Perdu. The passes in these mountains are locally termed *ports*, and are in some parts so dangerous, that it is proverbially said, "the father never waits for his son, nor the son for his father." In the midst of these rugged mountains, however, fertile spots are of frequent occurrence, to which the shepherd conducts his flocks in the summer months.

Lateral branches diverge from the Pyrenees, both to the north and south. Those which enter Roussillon and Gascony, are neither extensive nor lofty; but those which extend into Spain and Portugal, form long and elevated ranges of mountains, rendering the surface of those countries strikingly irregular. Physical Geography, we have already remarked, does not take into account the artificial or political divisions of the earth; and thus Spain and Portugal, being separated by no natural barrier, form only one region—

Where Lusitania and her sister meet,
Deem ye what bounds the rival realms divide?
  Ne river steep and wide,
Ne horrid crag, ne mountain dark and tall,
But there between a silver streamlet glides:
And scarce a name distinguisheth the brook,
Tho' rival kingdoms press its verdant sides.

One of the leading southern branches from the central range, is the Cantabrian range, which stretches across the whole northern coast of Spain, leaving only a narrow and rugged tract, intersected, however, by some fertile valleys, between the mountains and the sea. Another principal branch is the Iberian range, which diverges at right angles from the Pyrenees, and extends southwards nearly through the whole of Spain. From this range various collateral branches again diverge, generally taking a south-westerly course. Of these, the most northerly is the rugged and romantic Castalian range, which extends into Portugal, where it bears the name of the Sierra Estrello. The other collateral branches are the Sierra of Toledo, the Sierra Morena, and the Sierra Nevada. The latter range contains the most elevated summits in Spain. The line of perpetual snow in this latitude reaches the height of about ten thousand feet above the sea; and, as many of the summits in this range exceed that elevation, and some are more than eleven thousand feet, the tops of these mountains are covered with perpetual snow. Mulahacen, the most lofty, is 11,673 feet, and Veleta is 11,398 feet, above the sea level.

A plain of singular beauty and fertility, called the Vega, intervenes between the Sierra Nevada and the Mediterranean Sea.

> Thou land of love and loveliness, what dreams
> Of pomp, and beauty, and old chivalry
> Haunt the green borders of thy silver streams!

In the heart of the Vega stands the city of Granada, the situation of which is celebrated for presenting a remarkable combination of all that is most wild and sublime in natural scenery, with whatever is soft and beautiful. A romantic interest also attaches to the spot, enhanced by the striking appearance of the splendid city, crowned as it is by the Alhambra.

> Palace of beauty! where the Moorish lord,
> King of the bow, the bridle, and the sword,
> Sat like a genie in the diamond's blaze!

The whole country in the south of Spain presents a highly rich and varied vegetation, resembling rather that of Syria

than of Western Europe. The long sojourn of the Moors in this territory, and also the subsequent communication of Spain with the New World, led to the introduction of numerous exotic plants, the natives of Africa, and of intertropical America, which have become almost naturalized, and are here seen uniting their peculiar foliage with that of the most valuable and beautiful European species. Here grow the chesnut, cork (fig. 82)*, ilex, cypress, bay, myrtle, carob, or eastern locust-tree, (considered the most beautiful of European trees,) the vine, orange (fig. 43), lemon, olive (fig. 138), fig, pomegranate (fig. 17), mulberry, pistachio, or pistacia terebinthus, laurustinus, cistus, caper plant, and various others, accompanied by the date, dwarf-palm, American aloe, cactus, sugar-cane, convolvulus batatas, or sweet potato, and even the banana, or plantain. Oaks, beeches, and lindens or limes, occur only on the declivities of the mountains. The extensive plateaus, or table-lands, which occupy the centre of the kingdom, present a totally different aspect, being, in general, destitute of trees, and far from productive. In the low-lands, near the coast, however, the orange succeeds as far north as Oporto, lat. 41°, and the olive to lat. 42°. The fine plains of Valentia, again, which border on the Mediterranean Sea, are remarkable for their fertility, and their abundant produce of corn, wine, oil, and silk. The fruitful valleys situated in the tract lying between the Cantabrian mountains and the sea experience a very different climate. Independent of the more northerly latitude of this region, the situation of its principal mountain range tends greatly to produce this effect; for, instead of protecting it from the north, the Cantabrian mountains extend along its southern border, and though the north winds are tempered by crossing the ocean, its difference of climate is marked by its different vegetable productions; the apple-tree here taking place of the olive and the vine. The whole of Spain affords a striking illustration of the influence of climate on vegetation; and of the effect produced on temperature

* To avoid repetition, when the figure of a plant is referred to, Plate IV. will be understood as inferred.

by the elevation of land, and the relative position of mountain ranges.

The native animals of Spain are little known. The most remarkable appear to be the Alpine squirrel, which is peculiar to the Pyrenees, and the ibex, which inhabits both that range, and the Cantabrian mountains. The spaniel is considered a native of Spain. The celebrated merino sheep are said to have originated from the English sheep, some of which were sent to Spain as a present from Edward IV. to King John of Arragon.

The mountains of Spain are rich in minerals, among which may be mentioned, as the most remarkable, the excellent iron-ore of Biscay, the mighty lead-veins of Linares, the enormous deposit of the same mineral in the Sierra of Gador, and the rich mercury mines of Almeida. Rock-salt occurs in vast masses, especially at Cardona; it is also abundant in Portugal. Coal deposits are known in various parts of Spain; but the beds are usually thin, and the working of little importance. The rare deposit called meerschaum, is found near Madrid, and in other parts of Spain. Near Almeira, in Granada, is the remarkable rock of Filabres, which consists of a single block of white marble, two thousand feet in height.

Returning to our central axis, we next meet with the low range of the Cevennes, which may be considered as its continuation; though, in fact, they are separated from the Pyrenees, by the valley through which the canal of Languedoc extends. These mountains stretch in a winding line, along the left bank of the river Allier, parallel to the coast of the Mediterranean. The highest point in this range is Mont Mezene, which is nearly six thousand feet above the sea. The Cevennes are very steep and difficult of access, but were nevertheless passed by Julius Cæsar in the winter, through snow six feet deep. In later times these mountains afforded shelter to the Huguenots.

The mountains of Auvergne branch off from the Cevennes, and extend into the very centre of France. They consist, in great measure, of a group of ancient volcanoes, supposed to have been extinct long before the Recent Period. Among these, the most conspicuous is Mont D'Or, which rises suddenly

to the height of some thousand feet above the surrounding country, still retaining the form of a cone, though no regular crater can now be traced. The summit of this extinct volcano is 6707 feet above the level of the sea.

A branch of the great Alpine system separates France from Northern Italy and Switzerland. Some of the summits in this part are of considerable elevation, exceeding fourteen thousand feet; such are Luceira and Loupillon. The Jura mountains may be considered as a continuation of this branch, and the whole country on their western flanks is remarkable for its wild and picturesque character. These mountains which are chiefly composed of limestone, are broken into the most peculiar and romantic forms, and some remarkable caves and grottos occur, particularly those of Sassenage. Among the wildest and most forbidding of these rocks, stands the monastery of La Grande Chartreuse. The Vosges mountains, and others of inferior elevation, branch off from the Jura, constituting the eastern boundary of Northern France.

The centre of the kingdom is occupied by a table-land, or plateau, of considerable extent; but the greater portion of France, including the whole of the northern, and a large portion of the eastern districts, may be regarded as one widely extended plain, forming part of the Great European Lowland.

The vegetation of some parts of France nearly corresponds with that of Britain; and its mountains, although they possess some species peculiar to themselves, exhibit most of our Alpine plants. The northern lowlands admit of the successful cultivation of all the fruits and products of the lowlands of England, but, owing to the higher summer temperature of France, in greater perfection than with us. The southern and eastern districts, however, possess a very different climate; and there in place of wheat, grows the maize, accompanied by the vine and the olive.

The most northerly successful cultivation of maize differs in the eastern and western districts of France, extending in the eastern parts as far north as Strasburg, and not reaching beyond the mouth of the river Garonne, in the western dis-

tricts. A similar difference is observable with the vine, which, in the eastern districts, extends in full perfection to the country near Mézières, but in the western districts, not beyond the mouth of the river Loire.

We have already seen that the inland districts of any region usually experience more severe winters and hotter summers than those bordering on the coast; to this cause may be attributed the more northern range of these plants in Eastern France. The maize being an annual, cannot be affected by the severity of the cold; but it will be remembered, that it requires a high summer temperature to ripen well. The sap of the vine, again, is in a quiescent state in the winter, and is therefore protected from the frost, but a considerable degree of heat is required to impart richness to the fruit. The cultivation of the olive is chiefly confined to a tract lying between Narbonne and Grenoble, which appears to form its extreme northern limit.

A still warmer climate prevails on the borders of the Mediterranean, where the pomegranate, pistachio, jujube, fig, and mulberry, arrive at great perfection, and where, also, on the extreme borders of France, we first meet with the dwarf-palm, this being its most northern limit. Oranges, however, can scarcely be cultivated without shelter in any part of France.

France, besides possessing many native species, unknown as inhabitants of Britain, includes amongst its wild animals most of the species we have enumerated as extinct in our island. Thus, the wolf (fig. 23)* is still not uncommon in the wooded and mountainous districts; and bears, though now diminished in number, were at one time numerous. The beaver is said to inhabit the southern parts; and the wild boar still frequents some of the forests. This country possesses some beautiful birds; such as the gross-beak, blue-throated warbler, &c.; and also numerous insects, rarely, if ever, seen on our shores. The total number of known species of insects in France is about

* When the figure of an animal is referred to, Plate VI. will be understood as intended.



Maize.



The Olive.

15,000; the number of indigenous plants about 7,400: it will therefore be perceived, that the proportion of insects to plants is not so great as with us.

The mineral treasures of France are very considerable, and also very generally diffused throughout the country, Gers being the only department which does not in some way contribute to the mineral wealth of the kingdom. There are numerous coal fields in various parts of France; and iron occurs very abundantly, though the produce falls greatly below that of England. France also possesses mines of copper, of lead mixed with silver, of antimony, &c., but none of these are of great importance. Some considerable beds of rock-salt occur at Vic, in the department of Meurthe.

Returning to our central axis, we find it prolonged in the leading range of the great mountain system, on which the name of Alps has been bestowed.

These mountains are usually divided into nine groups; and although no natural division may occur, it will be convenient to treat of them under these heads. They consist of, 1st, the Cottian; 2nd, the Graian; 3rd, the Pennine; 4th, the Helvetian; 5th, the Rhetian; 6th, the Noric; 7th, the Carnic; 8th, the Julian. The 9th group, called the Maritime Alps, does not belong to the central band, but may be regarded as a branch diverging from that line, taking a southward course from Monte Viso; whilst the Cottian Alps, which form the first continuation of our central axis, and which also commence with that splendid mountain, take an opposite course.

Ere proceeding along our central line, it will be desirable to turn our attention to the important branch, called the Maritime Alps; an appellation, however, which is soon exchanged for that of the Apennines. These mountains, under the name of the Ligurian Apennines, first encircle the Gulf of Genoa; then taking a south-easterly course, they extend through the whole of Italy, the form of which corresponds strikingly with its mountain system. The slopes or declivities of the Apennines present, on either side, valleys and plains of the greatest beauty and fertility.

Thou Italy! whose ever golden fields
Ploughed by the sun-beams, solely would suffice
For the world's granary thou, whose sky Heaven gilds
With brighter stars, and robes with deeper blue:
Thou in whose pleasant places summer builds
Her palace!

The summits of the Apennines differ in appearance from the rugged Pyrenees, and sharp-poined Alps, being usually of a rounded form, and not of very great elevation, the highest not exceeding nine thousand feet above the level of the sea. Low undulating hills (known to geologists as the Sub-Apennines) skirt the northern slopes of the Ligurian Apennines, and cover a considerable extent of country, on both sides of the Etruscan and Roman portions of this range. Perhaps, however, the most important feature in Italy, is the volcanic district, which is almost confined to the central parts of the western side of the peninsula; and near the southern extremity of which, we meet with the energetic volcano of Vesuvius. To this district we shall have occasion to recur in a future page.

The valleys and lowlands of Italy, are no less celebrated for their beauty and fertility, than for the classical and poetical interest with which they are invested. The extensive plains of Lombardy are considered as the richest and most fertile in Europe, and the valley of Naples is celebrated for its highly beautiful and picturesque scenery; but perhaps they both yield to the vale of Tuscany:

The brightness of the world, O thou once free,
And always fair, rare land of courtesy—
O Florence, with the Tuscan fields and hills!
And famous Arno, fed with all thy rills,
Thou brightest star of star-bright Italy!

Some part of the Roman territory is picturesque and fertile; but a considerable portion is occupied by a swampy waste, called the maremma, whose pestilential influence renders that district uninhabitable at certain seasons of the year. On the eastern side of the peninsula, the Apennines approach nearer to the coast, sending forth spurs, or inferior branches, which present their bold cliffs to the Adriatic Sea. Nearly parallel

with Naples, however, a subordinate peninsula juts out, still known by the classical appellation of Magna Græcia, at one period the seat of the highest civilization, and whose capital, Tarento, was once a rival to Rome. This territory, little conspicuous as it is at present in the annals of Europe, contains plains which are described as of almost unrivalled beauty, finely diversified, and adorned with the richest groves of orange and citron. Some singular and beautiful caverns occur in the vicinity of Polignano.

The mountains of Sicily form a continuation of the Apennines; to this, however, Monte Gibello, or Mount Etna, may be considered as an exception, for this volcanic mountain, which is situated near the borders of the sea, rises in solitary grandeur to the height of 10,963 feet, the mass being chiefly composed of volcanic matter. The Lipari Islands, to which group Stromboli belongs, are all of volcanic formation. The island which bears the name of Lipari, is remarkable for its splendid display of the beautiful volcanic glass, called obsidian, and for its profusion of pumice; the pumice of commerce being principally obtained from that island. The island of Malta is not volcanic, but wholly composed of tertiary rocks, the highest point being only 590 feet above the sea.

The vegetation of Italy and Sicily is rich and varied, uniting most of the productions of temperate Europe with those of warmer climes. Thus in Sicily, by the side of the plane, poplar, and willow, grow the cactus, orange, and citron, or lemon (fig. 44), the olive, myrtle, laurel, carob tree, and promegranate; whilst the arbutus and tamarisk abound on the coasts. Here also are cultivated the date, custard apple, and sugar cane, whilst at the same time the wheat of Sicily is reckoned some of the finest in Europe. The elevated cone of Etna, affords an instance of the variation in vegetation as we ascend above the level of the sea. This is divided into three zones, the fertile, the wooded, and the barren. The first zone, which consists of the country at the base of the mountain, is covered with aromatic herbs, olives, vines, orange trees, and all the fruit trees peculiar to this climate; the second, or wooded, besides affording excel-

lent pasturage, abounds with cork, chesnut, beech, ash, oak, pine, and other trees; birch having the highest range. Beyond this, the desert region succeeds; which consists of a waste of black lava and scoriæ, forming a kind of plain, only varied in a few instances, by the sombre green of a species of broom. The principal cone of the volcano rises from this plain, and is about 1100 feet in height. Numerous smaller cones are scattered over the sides of the mountain, and many of these being beautifully wooded, they greatly contribute to the picturesque appearance of the mountain.

The vegetation and climate of Calabria much resemble those of Sicily. The summers are excessively hot, and frost is scarcely known. The soil is remarkable for its fertility, and the valleys are abundantly watered by the streams which flow down from the singularly wild and rugged, though picturesque, mountains. In the warmer parts there are large groves of orange and lemon trees, and of the red and white mulberry*; whilst the barren rocks are covered with the agave, cactus, and caper plant, which latter forms an object of commerce of considerable importance. The slopes and eminences produce the olive, pistachaio (both terebinthus and lentiscus), jujube, oleander (on the borders of the streams), dwarf palm, carob, manna-ash, cypress, bay (fig. 119), willow, &c., and also the Italian poplar (fig. 111), and the *pinus pinea*, or stone pine, whose picturesque and dark foliage forms such a peculiar feature in Italian landscapes. The mountains, again, are clothed from the base to the very summit, with chesnut (fig. 80), cork, oak, horse chesnut, yew, larch, Scotch fir, and other trees. Most of the vegetable productions of the Calabrian plains follow the line of coast, but it is only in the southern part of Italy that the Apennines can boast of this rich vegetation; in the more northern districts, the summits and upper portion of this range are destitute of trees; a circumstance, however, not so much to be attributed to the difference of latitude, as to their greater elevation above the level of the sea. The climate of Italy is

* The mulberry tree does not appear to have been introduced into Italy before the twelfth century.

peculiarly favourable to the growth of the vine and the olive. Owing to the excessive sweetness of the grapes, the wines are, however, generally luscious. The superiority of the olive oil of Western Italy is well known. That particular kind known as Gallipoli oil*, is the produce of the eastern region, called Magna Græcia. Maize and millet are very generally cultivated throughout Italy, though by no means to the exclusion of wheat. Rice, as has been already mentioned, is successfully and extensively grown in the plains of Piedmont; and the sugar-cane and cotton plant come to perfection, in Calabria, of



The Cotton Plant.

both which plants this may be considered as the northern limit of successful cultivation. Among its grasses, Italy produces one of those gigantic species so characteristic of warmer regions This is the arundo donax, which seems to take the place of our

* This oil is held in high estimation for the manufacture of fine woollen cloth.

common reed, and of which canes, fences, and other articles are made.

The island of Malta (an object of interest, on account of its having been the scene of St. Paul's shipwreck) is not naturally fertile, but, by careful cultivation, yields grain, cotton, and excellent fruit, especially oranges.

The native quadrupeds of Italy include the wolf and the wild boar. The porcupine is supposed to have existed formerly in Sicily, but is now extinct. Malta, like most other small islands, does not contain any native quadruped larger than a rabbit, and probably even these have been introduced. Among the most remarkable birds of Italy are the rose-coloured starling, (one of the most beautiful European birds, not, however, confined to Italy, being met with in other parts of Europe, and having been occasionally seen in Britain;) the blue thrush, which, like our less ornamented thrush, is a sweet songster; the hoopoe; and the crimson-winged wall-creeper. The migratory birds of Sicily are interesting from their including many species common to the opposite shores of Africa. Besides the immense flocks of quails, which pass over this island in the spring, bee-eaters, rollers, orioles, and hoopoes, are very numerous; whilst in the marshes are seen the African flamingo, the pelican, the beautiful purple heron, the glossy ibis, and other species, rare in Europe. Quails are also very abundant in Malta, where the beautiful merops, the golden oriole, and the elegant crested hoopoe are met with. The little solitary island of Lampidosa is remarkable for being the habitual residence of the most elegant of European birds, the coronated or crowned crane (*ardea pavonia*).

Among the insects of Italy, the tarantula spider is perhaps the most noted; recent naturalists, however, entertain doubts of the virulence of its poison. The scorpion occurs in Italy: and a species of termites, or white ant, inhabits Sicily. The insects of the latter island are very numerous, and comprise some well-known African species, among which is the scarabæus. Flights of locusts, almost unknown in the rest of Europe, have occasionally visited and devastated this fruitful island.

CHAPTER XII.

ALPINE SYSTEM.—SWITZERLAND.—THE GERMAN HIGHLAND.—CARPATHIAN MOUNTAINS.—DALMATIAN RANGE.—BALKAN MOUNTAINS.—GREECE AND TURKEY.

. . . . The Alp
Of horrid snow, and rock, and shaggy shade,
Of desert-loving pine, whose emerald scalp
Nods to the storm.—BYRON

WE now return to the Alps, which form so marked a feature in the natural geography of Europe. These mountains present neither the rounded outlines of the Apennines, nor the ruggedness of the Pyrenees, being generally more imposing in their form, and their summits being sharp, and in some parts pike-shaped or needle-shaped. The latter term is locally applied to some of the peaks; as, for instance, Aiguille Blanche; others are locally termed hornes, as Schreck-horn, or horn of terror; others again are designated by the term spitz, or peak, as Oertler-spitz.

The passes, which consist of the lowest passable routes over the various mountains, are, in the Alps, usually termed *cols*, or necks. The southern or Italian slopes of this range are in general more precipitous than the northern, and it is chiefly on the latter side, that offsets, or branches, diverge from the central line.

This mountain system does not spread into extensive table lands, but consists rather of vast ridges, in some parts running parallel with each other, and intersected by deep valleys, occasionally containing lakes of considerable size. The consequence of this great diversity of surface is, that a singular variety ot climate occurs in this region. The snow line in this latitude varies, according to local circumstances, from 9000 to 9500 feet above the level of the sea; and as a large number of the summits of this range considerably exceed that elevation,

perpetual ice crowns their heights; whilst on the declivities of the mountains, and in some of the valleys, we meet with all varieties of vegetation, from that of arctic regions, to that of temperate Europe. The highest summit is Mont Blanc, 15,781 feet above the sea.

Mont Blanc is the monarch of mountains,
They crowned him long ago,
On a throne of rocks, in a robe of clouds,
With a diadem of snow.

Our course first lies along the *Cottian Alps*, which extend from Monte Viso, in a nearly northward direction, to Mont Cenis, a distance of about sixty miles. The only carriage route across this part of the Alps is that of Mont Genèvre, executed by order of Napoleon. Another route, though not passable for carriages, is by the valley of the Bardonneche, which is supposed to have been the pass traversed by Julius Cæsar, when he crossed the Alps to attack the Helvetii. The principal mountains in this division are Pelvoux and Olan.

The *Graian Alps* extend from Mont Cenis—which is included in this group—to the Col de la Seigne. The pass over Mont Cenis was known in the early times of French history; for it appears that Pepin, emphatically styled the "father of Charlemagne," crossed this pass with an army, when he marched to attack Astolphus, king of the Lombards; it, however, in later times, was only a difficult mule road, until the present magnificent route was formed by Napoleon Buonaparte. The elevation of the pass is 6773 feet above the sea. Besides Mont Cenis, the principal summits in this group are Iseran and Vanoise.

The *Pennine Alps* take a north-easterly direction, extending from Mont Blanc to the Simplon. The country to the west of Mont Blanc, in the approach from Geneva, presents the grandest and most sublime Alpine scenery in Europe. The valley of Chamouni, the Glacier of Boissons, and the Mer de Glace, all contribute to produce this magnificent effect. The Pennine Alps form the loftiest portion of the whole range, and, besides Mont Blanc, include Monte Rosa and Mont Cervin,

which rank among the most elevated peaks of Europe. The first great pass across this division of the Alps is that by the Great St. Bernard, which forms the route between Martigny and Aosta. This pass is of great antiquity, and has obtained modern historical celebrity, by the passage of Napoleon Buonaparte across it in the year 1800. On the summit of the pass, at the elevation of 7963 feet, is situated the celebrated Hospice de St. Bernard, where travellers are received and gratuitously entertained for three days, by the hospitable monks of the establishment. The Alpine spaniels, those valuable and beautiful dogs, kept at this monastery for the preservation of travellers, and sent out in severe weather to scour the mountains in search of benighted and wayworn wanderers, are little less celebrated than their masters. To the eastward of the Great St. Bernard is the pass of the Cervin, the loftiest in Europe, being 11,096 feet above the sea, but it is not passable for carriages. The magnificent route of the Simplon, another work of Napoleon, but now unfortunately falling to decay, is the most eastward in the Pennine Alps.

The *Helvetian*, or *Swiss Alps* (called also the *Lepontian*), next succeed, extending from the Simplon to Mont St. Gothard. This, and the preceding group, form the southern boundary of the deep and extensive valley named the Valais, through which the river Rhone flows, and which forms an instance of a principal valley. The Rhone, as well as the Rhine, both take their rise among the glaciers and perpetual snows of the Helvetian Alps.

Having traversed the central line to the boundary of Switzerland, it will be desirable to quit it for the present, and turn our attention to some of the branches which intersect that land of mountains and valleys. The principal of these is the range of mountains called the Jorat, which forms the northern border of the Valais, extending to the Lake of Geneva, of which it constitutes the steep and rocky northern shores. The peaks in this range are termed horns, and though none of the summits equal Mont Blanc in elevation, these mountains present a more imposing mass, and more continuous

elevation, than even the range of the Pennine, or High Alps. The most conspicuous summits are Finster-aar-horn, Schreck-horn, and Wetter-horn.

The whole of Southern Switzerland affords scenery of the grandest and most pleasing description;—a succession of splendid mountains, intersected by deep and fertile valleys, which, being copiously watered by the streams which take their rise among these mountains, and also sheltered by the surrounding heights, enjoy a mild and humid climate, highly favourable to vegetation; and hence, in the more southern districts, the fig and olive come to perfection in the valleys, to the elevation of 1,000 feet above the sea; the vine, to that of 1,600 feet; the walnut extends to 2,400 feet; the chesnut to 2,800 feet; the oak, maple, and ash, to 3,800 feet; the larch to about 6,000 feet; and the Siberian pine to 6,800 feet. The spruce fir grows at a greater elevation than any other tree, but this ceases to flourish at 7,400, or about 2,000 feet below the snow-line. The *rhododendron ferrugineum*, commonly called the rose of the Alps, extends to 7,020 feet. Beyond the region of trees and shrubs, heath and furze are the principal occupants of the soil, though, in some parts, abundance of the more valuable product, Alpine grass, is met with; and beyond these plants, lichens and mosses alone occur. Among cultivated vegetables, wheat succeeds only in the sheltered and low plains; potatoes and barley generally thrive at the elevation of 4,000 feet, and, in some favourable situations, 1,600 feet higher; 5,600 feet above the sea being considered the utmost limit of their culture. Buck-wheat is much grown; and, at the elevation of 2,200 feet, it is sown after the rye-crop is gathered in, and ripens, though, in some places, not until the snow falls. The plant cultivated at the greatest elevation is the *rumex alpinus*, a species of sorrel, grown for fattening swine, which succeeds at the height of 5,900 feet.

The northern portion of Switzerland presents a different aspect to that of the southern districts, an extensive plain (comprehending the whole of the canton of Fribourg, and part of those of Berne and Soleure) occupying the western

region. In the eastern parts, however, we meet with some subordinate branches of the Alps, though no summits which reach the line of perpetual snow. The most remarkable among these are Mount Pilate, and Mount Righi, both situated in the Forest Cantons, a territory celebrated from having formed the scene of the exploits of William Tell. Mount Pilate rises in seven peaks round a little lake, concerning which a story is current among the peasantry in its vicinity, who believe that Pontius Pilate drowned himself in its waters. This fiction, however, appears to have originated in an error respecting the ancient name of the mountain, on the summit of which a cloud perpetually hangs, from whence the appellation of *pileatus*, *i.e.* covered with a cap, was bestowed on it; and this, in later times, being corrupted into Pilate, gave rise to the tradition.

The most remarkable native animals of Switzerland are the ibex (fig. 100), and the chamois (fig. 88), both of which frequent the most inaccessible precipices of the Alpine range. The Alpine marmot is another inhabitant of these mountains. The bearded vulture, or vulture of the Alps, is peculiar to Switzerland. Its strength is so great, that even the ibex and chamois fall victims to its rapacity.

Returning to our central line, we next pursue the course of the *Rhætian Alps*, so named from the ancient Rhætium. This group extends from Mont St. Gothard to the Dreyhorn spitz. There are five good carriage roads in this division of the Alps; the first is by Mont St. Bernardin, which forms the route from the Lago Maggiore to the Rheinwald: the second, which crosses the Splugen, is the line of road from the Lake of Como to the same point. These two routes unite at the village of Splugen, whence the road runs through the Via Mala, and the finest Alpine scenery of the Grisons.

The elevated Oertler spitz is situated in this group, which also contains a considerable number of other lofty summits.

The *Noric Alps*, so called from the ancient Noricum, next succeed. These mountains form a lofty range in their western portion, and include among their summits the Grand Glockner. Towards their eastern termination, however, they are

less elevated. Numerous passes occur in this division of the Alps.



Via Mala.

The *Carnic* and *Julian Alps* may almost be considered as one group; the ramifications of this part of the mountain system being so complicated, that the separation is not well defined. These mountains cover a large portion of Illyria, and the scenery in this region is remarkable for the wildness and beauty of its character.

The number of mines worked in the Alps is not considerable, when compared with the extent of the mountains. Gold, silver, copper, lead, iron, and quicksilver, however, occur in some parts, and also anthracite. The most celebrated among

the mineral deposits are the Bleiberg, or Lead Mountain of Carinthia, which furnishes some of the best lead in Europe; and the iron mines of Styria, equally noted for the superiority of their products. An amusing legend is current among the miners regarding the mines of Styria, the ancient Noricum. The Visigoths, at the period of the downfall of the Roman empire, having succeeded in expelling the Romans from this province, the genius of the mountains appeared to the new possessors, and thus addressed them:—"Make your choice;—will you have gold mines for one year; silver mines for twenty years; or iron mines for ever?" The legend proceeds to relate, that the hardy conquerors, having just practically experienced the superiority of their own rude iron weapons over all the gold and silver of the Romans, unhesitatingly accepted iron for ever*.

The Rhætian and Noric Alps send forth branches to the northward, covering Upper Austria with vast ranges, imparting to that territory a highland character, and presenting scenery of the most beautiful and romantic, though wild and rugged, description. To the north of this mountain region lies the valley of the Danube, an elevated plain, or table-land, more than one thousand feet above the level of the sea. The northern banks of the Danube are bordered by a range of mountains, dividing this valley from the low plains of Germany, which form part of the great lowland of Europe. This range of mountains is connected with those of Bohemia, which may be considered as forming the termination of the highlands of Germany. These mountainous districts include "dark Hercynia's wood" (the black forest), in Swabia, the Sieben Geberge, or Seven Mountains, on the Rhine, the metalliferous group of the Erzgeberge, in Bohemia and Saxony, the Forest of Thuringia, and the "Lemur-haunted Hartz." None of the summits in these mountains reach the limit of perpetual snow, which in this latitude is about 6,000 feet above the sea, the most lofty point being Schneekopf, 4,950 feet in elevation, and the general height ranging between 3,000 and 4,000 feet. The

* See *Schloss Hainfeldt*, by Capt. B. HALL.

Hartz mountains extend for more than a hundred miles along the borders of Hanover; the highest summit (which is included in that kingdom) is "Brocken's sov'ran height," from whence the eye descries—

> "Woods crowding upon woods, hills over hills,
> A surging scene.

The Hartz mountains, as well as many others in this range, are exceedingly rich in ores. Coal is also very abundant in Westphalia, Saxony, Bohemia, Moravia, and other parts; but the most extensive coal fields are in Silesia. Salt is likewise found in great profusion.

One of the most remarkable natural features of the extensive region of which we have been treating, is presented by the caverns of Illyria, which are said to exceed one thousand in number, and many of which form the outlets of subterranean rivers, whilst others receive them. The most extensive cavern is that of Adelsberg, the entrance to which is by two large apertures, into one of which a river flows, accompanying the visitor for about a mile in his underground course, when it plunges into an abyss, and is seen no more. At this point a double row of most magnificent caverns occurs, supported by pillars, and fretted with cornices of the purest stalactite; in some parts so beautifully arranged as to resemble the nave of a Gothic cathedral. This remarkable range has been penetrated to the length of six miles, where it terminates in a deep, clear, and cold subterranean lake.

The periodical lake of Zirknitz is another wonder of this territory. This lake is full in the winter and spring; but in the summer and autumn so entirely drained, that luxuriant crops of grass occupy its bed. The very extraordinary reptile, the *proteus anguinus*, an aquatic animal, resembling a lizard, is found in this lake.

The Carpathian mountains branch off from the Julian Alps, bordering nearly the whole of the northern and eastern frontiers of Hungary, and protecting its vast plains from the chill north winds, which sweep across the lowland of Europe, thus rendering its climate so mild, that the choicest productions

of Southern Europe are there raised in perfection, and the richest wines produced. The most celebrated amongst the latter is that called Tokay, the sweet and luscious qualities of which plainly evince the warmth of the climate in which it is produced, this wine forming a strong contrast to the poor and sour wines of some parts of Northern Germany, where a less genial climate prevails. But although Hungary possesses these advantages, the whole country is not equally fertile, some parts being bare and rocky, others covered with swamps, and others occupied by barren hills of blown sand.

Wolves are common in the Carpathian mountains, and bears are occasionally seen. Some of the most formidable birds of prey belong to this part of Europe. The great cinereous vulture is principally found among these mountains. It measures three feet six inches in length. The golden or imperial eagle also inhabits these districts. A striking difference is observable in these birds of prey; the latter royal bird will devour no prey unless captured by itself, whilst the less noble vulture preys only on dead animals.

The mines of Hungary are of considerable importance. Gold and silver are obtained in greater abundance from the mines of Schemnitz and Kremnitz, situated in a lower ridge of the Carpathians, than in any other part of Europe. This territory likewise yields iron, copper, lead, and mercury. There are also extensive deposits of coal and of salt. The fine stone, known as the true opal, is found near Kaschau, in Upper Hungary, and is by some authors supposed to be peculiar to this locality.

Returning to our central line, we next trace its prolongation in the Dalmatian range, called also (from Mount Dinara, the highest summit,) the Dinaric Alps. This range, which is situated between Hungary and the Adriatic Gulf, connects the Alpine system with the mountains of Turkey. The latter mountains, called the Balkan, extend from the Adriatic to the Black Sea. These mountains are very wild and rugged, and the higher summits are supposed to be covered with perpetual

snow. The most elevated are Mount Argentero and Mount Orbelus. The Great Balkan range in its eastern portion, where it is still known by its ancient Greek name of Hæmus, terminates abruptly on the shores of the Black Sea in a fine bold headland, called Emina Bournu, or Cape Eminah. Branches of great extent diverge from the southern side of the Balkan, the most westerly of which separates Roumelia from Albania, sending forth numerous spurs or inferior branches into the latter province, and imparting a peculiarly wild and rugged character to its scenery. The most easterly branch from the Balkan, called the Strandshea range, gradually approaches the shores of the Black Sea, forming the high and rugged coasts of the Bay of Burgos, and terminating in the Sea of Marmora: this point also constitutes the European termination of our grand central line.

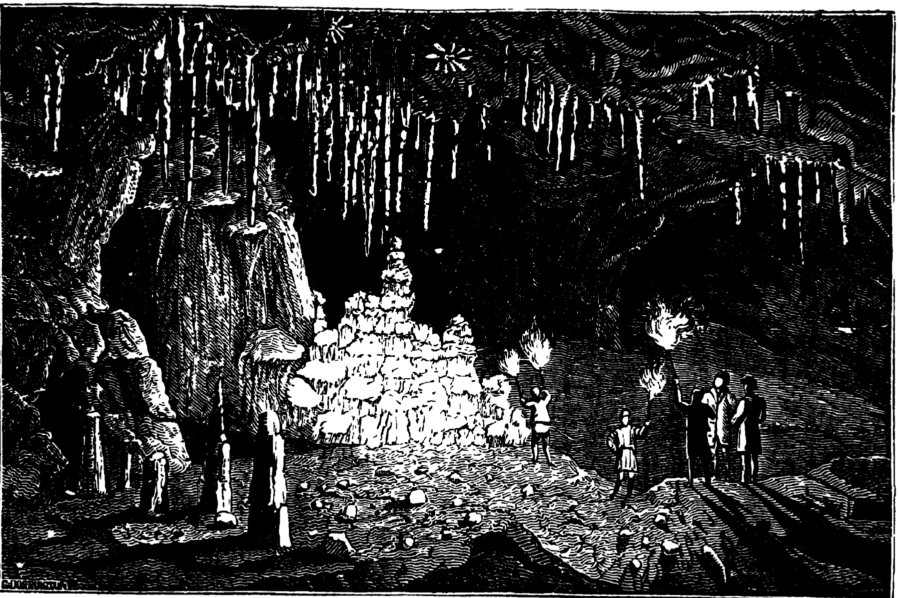
Extensive branches diverge from the Albanian range, and enter the territory of Greece:

> Clime of the unforgotten brave!
> Whose land, from plain to mountain cave,
> Was Freedom's home, or Glory's grave!

The line of separation between modern Greece and Turkey is chiefly formed by the mountain crests of Chelona, Pindus, and Othrys. From the range in which these are situated, various branches extend southwards, reaching to the borders of the Ægean Sea. Among these we meet with the classic names of Helicon, Olympus, and of Parnassus: the latter

> Soaring snow-clad through its native sky,
> In the wild pomp of mountain majesty.

These mountain ranges enclose numerous basin-shaped valleys of remarkable fertility, frequently only accessible by narrow passes; this configuration of the country having rendered it particularly adapted for the abode of several small independent states. Though changed the character of the inhabitants of this region, its natural productions are still the same as in its days of glory. The orange, citron, vine, olive, and myrtle, still flourish luxuriantly; the true laurel also, or sweet bay;



Grotto of Antiparos.

whilst the "empurpled Mount Hymettus," rich in aromatic herbs, is still celebrated for its scented honey. In the centre of the Morea rises the ancient Arcadia, consisting of an elevated table-land, containing in some parts beautiful valleys, but in others presenting districts of a rugged and even somewhat gloomy character, seemingly according better with its present poverty-stricken and care-worn inhabitants, than with the happy sylvan beings with which the imagination delights to people the plains of Arcadia. The elevation of this table-land above the level of the sea, causes it, however, to enjoy a delightful temperature during the summer months, when the plains at its base suffer from oppressive heat. Its mountains also attract and condense the vapour of the atmosphere; and this either descends in copious dews, or gentle and refreshing showers, and, sinking into the earth, gushes forth in numerous rivulets: and in the spring, its valleys are decked with the primrose and the deep blue violet; the banks of its streams adorned with the true poetical narcissus.

The islands of Greece are numerous, and generally partake of the beautifully varied and mountainous character of the contiguous mainland:—

> . . . . Who, O who, hath viewed,
> Untouched with rapture, those sunlighted seas,
> Fancy's primeval cradle!
> . . . . Who hath looked
> On those bright islands in the Ægean deep,
> . . . Nor from each time-honoured shore,
> Felt breezes redolent of glory blow!

The Cyclades though bold and rocky in their character, are nevertheless covered with the richest verdure, and intersected as they are by the waters of the deep, they present scenery of the most varied and attractive description. They are celebrated for their highly valuable statuary marble, that of the island of Paros being esteemed the finest in the world. The small island of Antiparos is remarkable for containing some natural caverns of very singular character, the roofs, floors, and sides being entirely covered with incrustations of alabaster

this being the only known instance of a similar formation. This incrustation is of the most dazzling whiteness, and assumes various fantastic forms; sometimes rising in splendid columns to the very roof, sometimes being suspended from thence in alabaster icicles, sometimes covering the surface with picturesque groups.

The island of Naxos, once celebrated for the worship of Bacchus, is still noted for producing good wine; but at the present day it is perhaps most remarkable for its produce of emery, nearly all the emery of commerce being obtained from this island. The volcanic island of Santorina, and its accompanying cluster, are remarkable for the changes which have at various periods been effected in the whole group, by violent volcanic action.

The richly wooded island of Samothraki, or Samothracia, possesses an interest of totally different character, being mentioned in sacred history as the spot at which St. Paul touched, in his way from Asia Minor to Phillippi. This island rises abruptly from the sea, to the height of 5,248 feet, being exceedingly beautiful, and covered with the most luxuriant verdure.

The island of Candia, the ancient Crete, is one of the largest islands in the Mediterranean, and is a spot highly favoured by nature. The interior is mountainous, and Mount Ida towers to a very considerable height; but the coasts are occupied by plains and valleys of unusual fertility, covered with groves of myrtles, plane trees of splendid size, and various other beautiful timber trees.

The Ionian islands, though not of great elevation, are rugged, rocky, and picturesque. The nature of their surface renders them ill-adapted for the growth of corn; but wine and fruits are produced in great abundance. That species or variety of small grape, called the Corinthian*, is extensively grown in these islands, to which, and the Morea, the plant appears to be peculiar. The extensive and fertile, though at present ill-

* Corrupted into *currants*, and largely imported into this country, in a dried state.

cultivated, plains of Romania, or Roumelia, the ancient Thrace, occupy the space between the mountains of Pindus and the Balkan range. To the north of the latter mountains are situated the plains of Bulgaria, which in some parts are bleak and rugged, and in others are covered with swamps and marshes, though a large portion of the country exhibits considerable beauty and fertility.

Beyond the river Danube spread the vast plains of Wallachia and Moldavia, which may be regarded as forming part of the great lowland of Europe. These plains are flat and marshy, in the districts bordering on the Danube; but as they recede from that river, (and more especially in their western parts, where they extend to the base of the Carpathian mountains,) the country becomes diversified and picturesque. The almost innumerable stagnant pools that occur in these plains render them unhealthy. This territory, in its more level parts, experiences an excessive climate; the summers being exceedingly hot, and the winters of such severity, that the Danube is usually at that season so completely and firmly frozen over for six weeks, as to bear the heaviest carriages. And yet, these plains are in the same latitude as the south of France, and in a warmer one than the most favoured districts of Hungary; to the latter of which, especially, they present a remarkable contrast, affording a striking illustration of the effect produced on climate, by local variations of the surface. The flat plains of Wallachia and Moldavia have only a trifling elevation above the sea-level, and therefore experience greater summer heat; but, being unprotected by any mountain range, or elevated land, from the chilling northern blasts which sweep across the low territories of Russia, their winters are thus severe. Hungary, on the contrary, as has been already observed, slopes gently towards the south, and is protected on the north and east by the Carpathian mountains.

The vegetation of Greece and Turkey, including the Grecian Archipelago, presents some features of more than usual interest. Diversified as is the surface of these territories, we shall be prepared to expect a varied vegetation; but this is by no means

all; we here meet with instances of the marked natural division in the floras of certain regions. In the countries over which we have passed, our attention has already been called to the influence of latitude, elevation above the sea, and other causes, on the natural limits of plants. It also appears that certain plants have easterly or westerly geographical limits, both as to their distribution, and the nature of their produce; subordinate, however, to the isothermal lines, by which the zones of vegetation are mostly determined. These limits, which perhaps may not inappropriately be termed *meridianal limits*, or *longitudinal limits*, are, in some cases, clearly dependent on the natural geography of the regions in which they may be traced; in others, however, the cause of their occurrence is less evident. More than one instance of these meridianal limits will be afforded by the region now under our consideration.

Greece forms the most westerly limits of various plants, well known in our groves and gardens as cultivated species, but which have never been found growing wild to the westward of the Adriatic, though they are indigenous in Greece, as also in Asia Minor, and other eastern regions. Among these, are the horse chesnut, weeping willow, almond*, common or cherry laurel, pomegranate, &c., &c. In this case the meridianal limit has evidently been dependent on the natural geography of these regions; these plants having been checked in their westward progress by the expanse of sea, including the Mediterranean and the Adriatic, which latter extends into too high a latitude to admit of their passing its northern shores.

Less evident, however, is the cause of another meridianal limit, which also occurs in this region. In the Grecian Archipelago we first meet with

Groves whose rich trees weep odorous gums and balm.

It is not, however, that the same species do not occur in more westerly regions, but that they are not "rich" in these

* This limit of the almond does not, however, apply to Africa, that tree having been found growing wild in Barbary.

"odorous gums" in those parts. Thus, we have already met with the pistacia lentiscus and pistacia terebinthus, in Spain and Italy: these trees, however, in those regions produce no supply of gum resin; but in the Grecian islands, and more especially in Scio, this substance exudes from them in great abundance. From the former (pistacia lentiscus) flows gum mastich, this being generally obtained by making incisions in the bark; whilst, from the pistacia terebinthus, or terebinth tree, gum terebinth flows naturally in a more liquid state. It is not easy, however, to assign a cause for this limit of the produce of these fragrant gums; the island of Scio is not in a more southerly latitude than the other countries in which we have met with these trees; and it would almost appear that these islands, bordering as they do upon Asia, partook of the luxuriance of its vegetation, and formed the western limit of the rich products of Eastern climes. The gums we have mentioned are by no means the only species which occur; gum tragacanth is the product of several plants of the astragalus kind, and gum ladanum of the gum cistus, and other species of cistus; and both these are particularly abundant in Crete. All these odoriferous gums are much used by the Turks for incense or perfumes; and it is a universal practice throughout the Ottoman empire for the women to chew gum mastich. These odoriferous trees are indeed so common in some of the Grecian islands, that they form the ordinary fuel of the inhabitant, nothing being used for that purpose, except the mastich tree, cedar, cistus, lavender, and other fragrant woods: so that, "not only is the air scented with the balsamic odour of the numerous aromatic plants, but the very smoke is perfumed with the fragrance of the wood of which their fires are made."

These islands again, and the neighbouring shores of Asia Minor, are remarkable as being the original habitation and western limit of some of our well-known, but much-esteemed, garden flowers; the tuberose, hyacinth, tulip, narcissus, ranunculus, anemone, &c., all being natives of this region. The ranunculus more especially abounds in Crete; the anemone in

nearly all the islands of the Archipelago, which, in the spring, appear like a rich carpet, being studded with anemones of all colours. These flowers, in their natural state, are usually single, and may in some instances have been improved by cultivation; but their hues are not less brilliant than with us.

The vegetation of the mainland of Greece and Turkey present, in the lowlands of its more southern districts, most of the plants we have observed in similar situations in Spain and Italy. Date trees are, however, rare; the only trees of this description known to exist in continental Greece being a few in the vicinity of Athens: though this is not attributable to the climate, for the prickly fig, which is equally tender, grows abundantly, forming strong defensive hedges. The orange and lemon are produced abundantly in the Peloponnesus, growing on the eastern coast, in Bœotia and Thessaly, nearly as far north as the range of Mount Olympus, not, however, coming to full perfection in the lovely Vale of Tempe, situated to the south of that mountain. But in the western districts, sheltered as these are from the north-east by the Albanian mountains, the range of these plants extends to the Gulf of Quarnaro; whilst the olive, fig, myrtle, mulberry, manna ash, stone pine (fig. 145), pinaster, terebinth tree, and their usual accompaniments, skirt the shores as far as the extremity of the Adriatic. It is only, however, near the coast, that these plants of warmer zones are met with; at a short distance inland they altogether cease, and are succeeded by the chesnut, ash, lime, horse chesnut, mountain ash, service tree, wild apple and pear trees, oak, &c. The latter, crowned with the true ancient miseltoe, still flourishes in the highlands of Arcadia, where, under the Greek mythology, every oak had its dryad. The mountainous regions are covered with forests of beech, pine, Scotch fir, &c.

The native animals of Greece and Turkey are little known. The most remarkable are, perhaps, the Cretan sheep and the musmon sheep, both of which appear to be natives of the island of Crete. The Cretan sheep is noted for the singularity of its horns, which, first turning outwards, form a complete

circle, then, taking a vertical direction, ascend in a spiral form. The wild musmon sheep, which is said to be still found in the mountains of Crete, is supposed to be identical in species with the numerous races of sheep now spread over Europe. The Albanian dog has been celebrated from remote antiquity, and is a very beautiful animal, with long silky hair. The Turkish greyhound, on the other hand, though well formed, is an ugly little animal, the skin being almost destitute of hair.

Among the known birds, the most interesting are the pink coloured flamingo, the pelican, and the stork; which latter is said to build unmolested in the ruins of the ancient temples.

The silk-worm was introduced into Greece by Justinian, in the sixth century; and shortly afterwards the *mora*, or mulberry tree, became so abundant in the Peloponnesus, that the name of the latter was changed to the Morea.

CHAPTER XIII.

EUROPEAN LOWLAND.—BELGIUM.—HOLLAND.—DENMARK.—LOWER GERMANY.—POLAND.—RUSSIA.—NORTHERN HIGHLAND OF EUROPE.—SCANDINAVIA.

> Sweep by Holland like the blast·
> One quick glance at Denmark cast,
> Sweden, Russia;——all is past.—MONTGOMERY.

HAVING now traced our grand central line, and its subordinate branches, across the whole of Europe, it will be desirable, ere we follow the course of this mighty mountain range through Asia, to take a glance at some important portions of Europe, which we have still left unexplored, namely, the Great Lowland, and the Northern Highland.

The Great Lowland, as has been already remarked, includes the Netherlands, Denmark, the northern districts of France and Germany, nearly the whole of Poland, and the greater part of Russia.

We have already taken some notice of that part of France which is included in the Great Lowland: Belgium and Holland form a continuation of this extensive plain. Spurs, or minor branches, from the Rhenish mountains, extend into the south-east districts of Belgium, giving a hilly character to that portion of the kingdom; but it is in general flat and undiversified: though not in so remarkable a degree as the kingdom of Holland, which forms the lowest portion of the Great Lowland, being in many parts nearly on a level with the ocean. Owing to the trifling elevation of this country above the sea, it was exposed to the risk of inundation at every high tide; but the mighty work of constructing barriers and dykes has been effected, and the land rescued from the overwhelming waters. In olden time, too, a large proportion of this region consisted of harsh barren sands, producing nothing but heath and fir. The whole territory has, however, been cultivated like a garden, and brought to a state of the greatest fertility; thus in every way affording a striking example of the triumph of human industry over natural difficulties, but presenting little to arrest our present attention.

Holland does not contain any valuable mineral deposits, and the fuel used is chiefly turf or peat. In the southern districts of Belgium a vast coal field occurs, forming a portion of the largest coal district known to exist in Europe. It is stated that there are three hundred and fifty mines in Belgium alone. Mines of iron ore also occur, and the mineral called black chalk.

The kingdom of Denmark forms another portion of the Great Lowland: this country presents a nearly flat surface, and the soil is generally sandy; but owing to its insular situation, and the consequent humidity of its climate, many of these level sandy tracts are converted into marshes. From the same cause it is not subject to severe frosts, but its summers are chilly and moist, so much so indeed, that wheat will not ripen, though rye, barley, and oats are extensively cultivated.

The northern parts of Germany consist of one vast plain, in some parts so low that dykes are required to protect it from

the encroachments of the ocean. Probably no country of equal extent occurs in Europe, possessing a less fertile soil than this plain; and were these tracts deprived of the abundant supplies of rain and snow which annually descend upon the surface, there can be little doubt that they would soon be as arid as the sandy deserts of Africa. The winds which sweep across these plains produce, as we have already noticed, (according to their spring chilly moisture, or their autumnal aridity,) much effect on the temperature of our eastern counties. The whole country in this part is nearly destitute of trees, and presents little besides these sandy wastes and peat bogs, alternating with tracts covered with heath and juniper; with the exception, however, of the banks of the river, and of a fertile tract occurring near the centre of the plain, which acquires its different climate from being enclosed between some hills, branching off from the Great Southern Highland, and which extend into this part of Germany. The river Elbe crosses this plain, and to the eastward of that river the general fertility is greater, the sandy tracts, in lieu of being destitute of vegetation, being covered with vast forests of pine. The whole of the coast bordering on the Baltic is, however, flat and sandy; but the larger rivers, especially the Vistula and the Niemen, form deltas of alluvial soil at their mouths, and these spots are exceedingly fertile.

A ridge of more elevated land crosses the northern part of the Germanic plain, extending from Holstein to Dantzic, and taking a general direction from east to west, the course of which may be traced by the *water-shed*, or course of the small rivers which take their rise in this ridge, on the one side falling into the Baltic, and on the other, uniting their streams with the Elbe, the Oder, and the Vistula. On the northern side of this ridge, and even in some parts to the southward of it, vast numbers of erratic blocks or boulders are found, composed of the same description of rock which forms the mountains of Scandinavia; from whence these boulders are supposed to have been transported, at some ancient though unknown period.

Poland may be considered as a continuation of the plains of Germany, and forms another portion of the Great European Lowland, with the exception, however, of the provinces of Lodomiria, and Galicia, which are more elevated, and of diversified character; being thus greatly improved in climate, they are generally exceedingly fertile, and in some parts covered with dense forests. The flat districts of Poland are chiefly occupied by deep layers of sand, alternating with damp clayey tracts; and as these plains are open to the north, the winters are exceedingly severe, and the country is subject to violent winds, blowing almost uninterruptedly across that wide level expanse.

Allusion has already been made to the mineral deposits of Upper Germany: the flat districts of which we have now been speaking do not contribute much to the mineral wealth of Europe. The same remark applies to the level districts of Poland; though in that territory, lignite, or brown coal, is found, and amber occurs in the same deposit. In the more elevated southern territory of Galicia, (though this perhaps belongs rather to the Southern Highland of Europe,) beds of bituminous coal, resembling that of Britain, are met with, and extensive deposits of salt; the whole substratum in this district being more or less impregnated with the latter mineral. The principal salt works are those of Bochma and Wieliczca; the former of which is celebrated for the superiority of the salt produced, the latter for the vastness of the works, which are perhaps the most extensive in the world: the excavations in the mine of Wieliczca are said to extend seven or eight miles in length, to be nearly a mile and a half in breadth, and to reach to the depth of from three to four thousand feet. The passages and caverns cut out of the solid salt present a sparkling and beautiful appearance; and, to add to this general effect, some elegant little chapels or oratories, adorned with figures of saints, have been cut out of the mineral. The stables for the horses employed in the works are also cut out of the solid rock salt.

The vegetation of the Netherlands, of the German Lowland,

and of Poland, exhibits, generally speaking, much resemblance to that of Great Britain, and of Northern France: the coast districts, which possess an insular climate, approaching in character to that of our island; and the inland districts, which, from their continental situation, experience a more excessive climate, resembling that of Northern France. The majestic Rhine,—on whose banks we behold

> A blending of all beauties; streams and dells,
> Fruit, foliage, crag, wood, corn-field, mountain, vine,—

flows through the western part of this Lowland. In this beautiful district, wine is produced as far north as latitude 51°. But this wine, well known as hock, or hock-heimer, though equally, and to many tastes more agreeable, than the rich and luscious wines of some parts of Southern Europe, exhibits by its deficiency in body and sweetness, the effect produced by climate on the fruit of the vine: and this is yet more strikingly displayed in the poor and hard wines which are made on the banks of the Elbe and Oder, a considerable portion of which, indeed, is used only for vinegar. All the grains capable of being cultivated with us are advantageously grown in Germany, though rye forms the staple food of the great body of the people. The forests of Germany are very noble, and include most of our well-known timber trees. Cherries and other wild fruits are met with in great abundance in these woods, and form a considerable resource to the poor as an article of food. The wild boar (fig. 74) still inhabits the forests of Germany.

In European Russia, the Great Lowland expands to the breadth of twelve hundred miles, presenting the largest extent of level surface in Europe, being only interrupted, as before mentioned, by the Valdai Hills, and chiefly consisting of immense levels, denominated *steppes*, terminating only at the base of the Oural or Uralian mountains, which form the boundary line between Europe and Asia, and which separate these vast plains from the no less extensive steppes of Northern Asia. In the southern districts, however, and especially in the Crimea, we meet with some steep and picturesque, though not elevated, ranges of hills.

Few mineral deposits of importance have hitherto been discovered in European Russia. Good coal has, indeed, been found in some districts, but the mines of that invaluable material do not appear to be considerable. Some iron mines also occur; and copper is found near the base of the Uralian mountains, a large tract of country being covered with a peculiar formation, which, from its containing a large proportion of that metal, is called copper sand. A very extensive deposit of salt also occurs in Russia. Erratic blocks are very numerous in the plains which extend from Petersburgh to the rivers Dwina and Niemen: they are formed of granite, resembling that of the mountains of Wiborg in Finland.

Level as is the surface of this vast territory, it will afford no striking instances of the variation of vegetation at different elevations; but, extending as it does through about twenty-six degrees of latitude, it exhibits a great diversity in its vegetable productions; and these bear a general resemblance to those of the countries we have already explored, though they present some peculiarities which it will be interesting to consider.

The climate of the Crimea approaches to that of Greece and Italy, and a considerable similarity exists between its vegetable productions, and those of the latter regions. The vine is indigenous in the Crimea, abounding on the hills, there being two species, one of which produces small round black grapes, and the other oblong grapes of a greenish white colour. With these vines grow red and white roses, the sweet clematis vitalba, or virgin's bower, jasmine, &c.; whilst in the spring, the hills and eminences are diversified and enriched with the brilliant hues of the various flowers, with which the earth is adorned; sometimes one species, sometimes another prevailing, according to the nature of the soil, or aspect of the hills, which form the natural abode of the different species; whilst the air is perfumed with the odour of their blossoms, to which the violets, which are exceedingly abundant, do not slightly contribute. Among the wild fruit trees of this district, are cherries, and early and late apples and pears; the sloe grows in the greatest luxuriance; but wild plums are not common; nor do

peaches and apricots succeed when cultivated. Among the forest trees, we meet with oaks of splendid dimensions, as well as the linden or lime tree (fig. 40), beech (fig. 79), elm (fig. 100), poplar, maple, ash, &c. Among the shrubs we find the lantana, or way-faring tree (the wood of which is used to form tubes of tobacco pipes, in great request in Russia and Germany); the pyracantha, caper bush, &c. Maize and millet, as well as wheat and barley, are cultivated; cucumbers also, of large size; and gourds of various sorts. Hemp (fig. 89) is much grown, and the flax (fig. 33) grown in this part, is greatly esteemed on account of the fineness of its fibre.

The level plains of Southern Russia, which are watered by the great and broad rivers of the Dnieper, the Dniester, and the Don, are chiefly covered with luxuriant pastures, though where they have been brought into cultivation, they have produced remarkably abundant crops of the finest wheat. Extensive forests, consisting of oak, elm, mountain ash, or rowan, &c., also abound in some of the Central districts; but those parts distinguished by the name of the East Sea provinces, consist of a flat, dreary country, buried in snow during half the year, and occupied by forests of birch and pine. In this district, in place of maize and wheat, we find the hardier kinds of grain cultivated, and these succeed only in the most favourable spots. In the whole of Northern Russia the oak is unknown, but the arctic provinces are overspread with vast forests of pine and fir; the pine, or Scotch fir, being particularly abundant. It is remarkable, that the greater the intensity of cold (within certain limits), the firmer and more compact does the timber of the latter tree become. The value of trees which do not lose their leaves in winter, and consequently afford shelter, not only to animals, but to man, during that inclement season, is much more sensibly felt in these wintry regions, than in temperate zones. Beyond a certain point, however, these trees become stunted, and at length, as we approach the shores of the Northern Ocean, they totally disappear. The birch trees, which have accompanied them in their northward progress, extend beyond the coniferous or

cone-bearing trees; extensive forests of birch (fig. 83) occurring in the more northern districts. These, in their turn, however, become stunted, and we find a large surface occupied by the arctic bramble (fig. 55), whilst the dwarf willow (fig. 108) extends almost to the utmost limits of vegetation.

The Russians turn to economical purposes, many vegetable productions considered of little account among us. Thus, of the bark of the birch tree they make cordage, fishing nets, and even sails for the boats used on the lakes; a kind of oil is also extracted from this tree, called *diojet*, which is used in the process of preparing Russia leather, to which it imparts its peculiar odour and colour. The lime or linden tree is also a valuable tree in Russia, ropes being made from the inner bark; and the garden mats, so extensively employed in our country, and called bass matting, are all imported from Russia, and formed of the same material.

The long continuance of winter in Northern Russia, and the consequent failure of supplies of fresh vegetables, leads to the extensive use of preserved berries of various sorts, as substitutes for these important accompaniments to animal food. Thus, the berries of the mountain ash, or rowan tree, which with us are only valued from their ornamental appearance, or from affording food to the feathered tribes, are in Russia collected in vast quantities, and with cranberries, and various other wild berries, salted for a winter store. This tree appears to attain a magnificent size in the northern parts of the empire, and

> Decked with autumnal berries that outshine
> Spring's richest blossoms, yields a splendid show
> Amid the leafy woods.

The juniper also grows to a remarkable size in Russia; and cranberries and bilberries are exceedingly abundant. We thus find, that though the climate is unsuited for the produce of more temperate lands, it is peculiarly adapted for the growth of its appropriate vegetable productions; and some of these berries form a constant addition to the meal of the peasant. Potatoes have been introduced: and are capable of being cul-

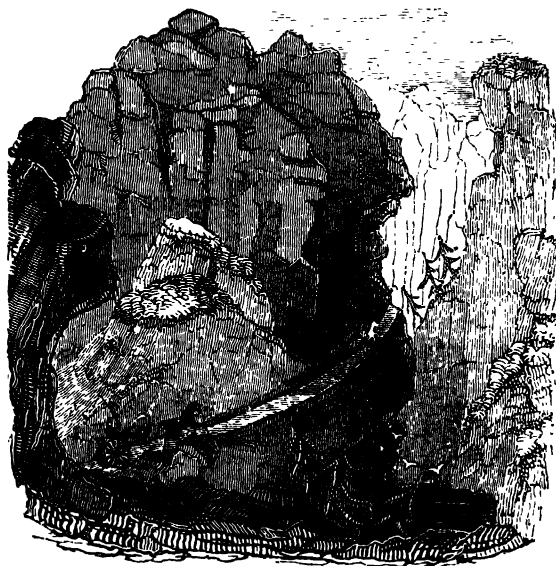
tivated as far north as Archangel; to which place the culture of hemp and flax also extends.

The wild quadrupeds of this extensive territory are numerous. Among these, the most remarkable is the urus, or zubr (fig. 95), which anciently inhabited the whole tract between the Baltic and the Balkan mountains, and probably extended across the whole of Western Europe, even to Britain, but which is now confined to a single habitation, the wild and swampy forest of Bialowieza, in Lithuania. Wolves, bears (fig. 30), and the other European animals, also abound in the forests of the Central districts. The most remarkable animals of smaller size, are the bobac, or Poland marmot, and the Alpine, or calling hare. These animals, and especially the latter, form a striking instance of the instinct with which certain animals are endued, and by which they are adapted to the natural habitations assigned them. The Alpine hare, or pika, inhabits the thickest and most sequestered forests, in the more elevated and cold regions of Northern Europe. This animal feeds only on vegetable substances, and of these, in the region it inhabits, there is necessarily a complete failure for many months in the year; but, guided by instinct, the Alpine hare amasses an ample store of provisions against the winter. About August, these animals cut and collect large parcels of grass, which they spread and dry, and in effect, convert into hay: this they collect into stacks, about seven feet high; they then excavate a subterranean passage, which opens under their stack; and by this, they obtain access to it from their burrow: the whole being, during the winter, entirely enveloped in a deep covering of snow.

The *Northern Highland* of Europe comprises the whole of Scandinavia, including Sweden, Norway, and Lapland. The mountain system of this region is wholly independent of the grand central line, and the elevated districts of North Britain are considered as detached portions of this range. This mountain system, known as the Dofrines, or Dofrafeld range, traverses the whole of the western side of Scandinavia from north

to south, extending for nearly a thousand miles. It exhibits many bold and lofty summits, covered with perpetual snow; the most elevated of which, is Sneehatta, rather more than eight thousand feet above the level of the sea. The mountains of Olonetz, in Finland, may be considered as belonging to this mountain system.

The Dofrafeld Mountains send forth spurs, or minor branches into Norway, the whole of which country is situated between these mountains and the sea, and consists of a narrow region, in some parts not exceeding 150 miles in width, rugged in the extreme, though intersected by numerous valleys; among which, the most extensive and beautiful, as well as celebrated in Norwegian tales, is the valley of the Guldal, in the province of Drontheim, said to have been the abode of the



Pass between Scogstadt and Vaug.

mighty Haco, and of the wise Olaf. These valleys are frequently difficult of access, and the scenery in the Norwegian mountain passes, is of a bold and picturesque character.

Fiords, or inlets of the sea (resembling the Scottish lochs), intersect the shores of this region in all parts, winding their way among the lofty and threatening rocks. This district, steep and rugged as it is, partakes of the milder climate belonging to the western side of the Old Continent; and it will be remembered, that Drontheim forms the most northerly limit in the world, of the successful cultivation of wheat. These fiords also, where not exposed to the full force of the vast ocean which dashes against their shores, are clothed to the water's edge with forests of pine, fir, and juniper; behind these woods, rise magnificent hills upon hills, until the latter terminate in the snow-capped summits of the Dofrafeld; the whole presenting a scene of the most striking and picturesque description.

Lateral branches extend from the Dofrafeld range into Sweden; but the centre of that country is occupied by an immense plain, intersected by numerous picturesque lakes, and covered with vast forests. The southern portion of Scandinavia, called Gothland, or Gotaland, consists of a large peninsula, and from its sheltered and insular situation, it enjoys a milder climate than any other part of Scandinavia. The more northern districts, known by the name of Norrland, possess a very cold climate, arising not only from the higher latitude, but also from the elevation of the land above the sea. The snow line, in this part, descends to the limit of 3000 feet above the sea; and not only are the mountains perpetually capped with snow, but large elevated table-lands occur, which never lose their icy covering. Even in the more favoured districts of Norrland, the trees become stunted, and the most hardy species of grain alone are capable of cultivation in a few sheltered spots; the potatoe has, however, of late years been introduced, and cultivated with advantage.

Lapland is situated almost entirely within the Arctic circle, and consequently experiences a very severe climate, not, how-

ever, by any means so intense as that suffered by regions in the same parallel of latitude, in North America. The surface of Lapland is much varied; extensive level tracts occurring in some parts, whilst others are covered with mountain ranges, the most elevated summits of which are about 4000 feet above the sea-level. The coast presents a continuation of the same bold and rocky features which characterize the shores of Norway. Numerous islands lie off this coast; in the island of Qualoe is situated Hammerfest, the most northerly town in the world; and on the island of Mageroe, yet further north, stands the little village of Kelvig, where four or five families reside. This island rises almost perpendicularly from the sea, and at its remotest point is the North Cape, forming the extreme northern boundary of Continental Europe. This cape consists of an enormous mass of bare rock, presenting its bold face to the winds and waves of the Arctic Ocean; not, however, altogether unscathed, for large portions of the rock are continually undermined and thrown down, and the island thus becomes gradually reduced in size.

Finland, in its natural features, greatly resembles Sweden; consisting of a succession of hill and dale, abounding in forests of fir and birch, and interspersed with numerous lakes; the surface of the country is overspread with shattered fragments of granite. The winters are more severe than in Sweden, and at that season of the year, Finland is covered with a hard uniform surface of ice and snow, in which the roads are indicated by boughs of fir; and the Gulf of Bothnia is so completely frozen over, that sledges cross from Finland to Sweden.

The mines of Scandinavia are peculiarly rich in important products. Coal-mines have long been worked in Sweden; and iron is very extensively diffused both in Sweden and Norway. The iron obtained from the mine of Danemora, in Sweden, is considered as the finest in the world, and is used for cast steel in our manufactories at Sheffield. Lead mines of some importance are met with in various parts of Sweden; and a most extensive deposit of copper occurs in the province of Dalecarlia. The silver mines of Könsberg, in Norway, are

the richest in Europe: the silver mine of Sahla, during the reign of Queen Christina, yielded annually 20,000 marks of silver, but at present this mine does not afford above 2000 or 3000. The mine of Adelfors, in Gothland, is celebrated for its produce of gold. The working of this mine began in 1738, and for some years it yielded thirty or forty marks of gold annually, but now it only furnishes three or four. The porphyry quarries of Elfdal are the largest and most celebrated in Europe, the greater part of the fine modern works formed of that material, being executed in the porphyry of Elfdal.

The vegetation of the more southern districts of Scandinavia much resembles that of the northern and mountainous districts of Great Britain; the peninsula of Gothland being almost the only district where wheat can be cultivated with advantage; and in the latter district extensive barren tracts of blown sand have, within a recent period, by careful and judicious cultivation, been consolidated, and covered with plantations of corn and timber. In the other parts of Scandinavia, only the hardier species of grain—rye, oats, and barley—are capable of cultivation, and these only in situations favourable to their growth. The most northerly cultivation of barley, however, occurs in this region, which comes to perfection in some sheltered spots, in Western Lapland, nearly as far north as latitude 70°. The peasantry used formerly to grind the bark of the fir-tree to make bread; and even in times of scarcity, occasionally to add to this, the remarkable mineral substance called berg-mehl, or mountain meal. The potatoe has, however, within late years been introduced into this region, and cultivated with considerable success, to the utmost limits of barley: and agriculture in general has been greatly attended to.

Vast forests occupy a large portion of Scandinavia, consisting chiefly of the birch, the Norway spruce fir (fig. 149), and the pine, or Scotch fir (fig. 141). The poplar, alder (fig. 87), and willow, are also indigenous. The superiority of the Norway timber renders it an object of considerable importance as an article of commerce; and thus, although the nature of

the climate may deprive the inhabitants of this territory, of some important vegetable productions, it appears to render others more valuable; and thus, by a mutual interchange of productions, different nations may be benefited. The Norway spruce fir is particularly valuable for masts of ships; it also yields abundance of tar, pitch, and turpentine, the Burgundy pitch of commerce being the produce of this tree. Its form is very regular, and it is distinguished by its pendant cones.

In the colder and more elevated districts, the spruce-fir appears as a slender pole, covered from the ground with short drooping branches; whilst the Scotch fir, on the contrary, has a short stunted stem, with widely-extended branches. Generally speaking, the trees in the Scandinavian forests do not attain any great height, and in the more northerly parts become very low and stunted. Beyond the region of the spruce and Scotch fir, the dwarfish forests consist only of birch, intermingled with a few aspens and mountain ash trees, which, however, do not ripen their fruit; but some juniper-bushes still occur. At 800 feet below the snow-line, the birch is no longer erect, but creeps upon the ground; though some plants of the willow kind still attain the height of two feet. The only berries which ripen in this situation are those of the crow-berry; but it is not a little remarkable, that these are twice as large, and at the same time better flavoured, than those which grow in regions more favoured by nature. The andromeda, the campanula, and the azure gentiana, still adorn these ungenial territories; these cease at 200 feet below the snow-line, whilst some saxifrages and a few other plants extend to that line. Nor is vegetation wholly suspended beyond the limit of perpetual congelation; for on some of the mountains bordering on the Northern Ocean, in the remotest parts of Finland, a partial thaw appears to take place under the covering of snow, creating a moist and in some places even a boggy soil: in such situations, at the elevation of 500 feet beyond the snow-line, the ranunculus glacialis is still met with; and also the little dwarf willow, whose diminutive size, scarcely



Norway Spruce Fir.—Abies Excelsa.

above a foot in height, might have induced us to regard it as an herbaceous plant.

Scandinavia abounds in cryptogamic plants, both of the fungus and the lichen kind; among which is the cudbear (fig. 216), used in dyeing, large quantities of this lichen being collected and exported for that purpose. And, destitute as the more northerly districts of this region appear of useful vegetables, the bountiful Author of Nature has not left them unprovided with productions suited to the sustenance of the creatures whose natural habitations are fixed in these high latitudes. A remarkable instance of this is afforded by that species of lichen, called rein-deer moss (fig. 218), a plant which, in other climes, where rich pastures abound, might be regarded as of little value, but which constitutes the chief support of the rein-deer, and thus, in fact, remotely, though not directly, of the human inhabitants of those regions, for, without that highly useful animal, the Laplanders could not subsist. "Thus, things which are deemed the most insignificant and contemptible by ignorant men, are, by the good providence of God, made the means of the greatest blessings to his creatures*." This lichen grows so luxuriantly in this cold climate, that it is sometimes met with, a foot in height: its utmost limit is about 800 feet below the snow-line.

The native quadrupeds of Scandinavia present us with some of those species whose range extends over the northern parts of both the Old and the New World. Among these are the glutton, considered identical with the wolverine of America, and the elk. In Scandinavia, the range of the latter animal is between latitude 53° and 65°. Scandinavia also ranks among her native quadrupeds, the lynx, beaver, lemming (fig. 54), flying squirrel, stag, fallow deer, &c.; and the Laplander's treasure, the rein-deer (fig. 87). The rich are said sometimes to possess herds of from 1000 to 2000 of these useful animals, —the poor, seldom less than 100. During life, the rein-deer supplies its owner with labour and with milk; and after death, every part of the animal becomes serviceable. Cows

* Linnæus; quoted in *Encyclopædia of Geography.*

and sheep have been introduced into these regions, but such is the effect of climate on those animals, that in Finland, the cows are said not to exceed a bull-dog in dimensions, and sheep to be about the size of a large cat.

The birds include the golden eagle (fig. 113), and the greater number of species which inhabit northern Europe; but among those peculiar to these cold regions, are the mocking-jay, the nut-cracker, the great snowy owl, and the gigantic Lapland owl, the latter being confined to the dreary solitudes of Lapland. Both these owls prey upon the various species of grouse and ptarmigan, which are so numerous in these northern latitudes, and among which is the cock-of-the-rock, the largest known species of grouse.

The insects are numerous, more especially in the lowlands, and the gnats swarm in myriads; these annoying little creatures being far more numerous, for a short season, in these high northern latitudes, than they are in the swampy woods of tropical America; in some parts rendering the country almost uninhabitable.

A geological phenomenon of great interest is afforded by this portion of Europe. The whole country from Fredericks-hall, in Sweden, to Abo in Finland, and perhaps as far as St. Petersburgh, appears to be gradually and insensibly rising; the rate of elevation being estimated at about three feet in a century. It was long supposed that, instead of a progressive rise taking place in the dry land, the waters of the Baltic were gradually diminishing; but careful investigations have demonstrated, that this change of relative level does not take place in all the shores of that sea; none occurring to the south of Scania. The causes which are effecting this extraordinary, though peaceful revolution, are concealed from our knowledge; and it is not a little remarkable, that scarcely any region has been more free from earthquakes within the historical period, than Scandinavia. We have already mentioned that the volcanic bands, both in the Old and New World, extend in the direction of the mighty mountain ranges which traverse each of those vast continents; and it is a subject well deserv-

ing our attention, that this northern highland of Europe, which is detached from the grand central line, and remote from the volcanic band, should thus present the phenomenon of an elevatory movement of different character, which appears to be raising it above the low plains of Northern Germany.

The Faroe Islands are rugged and mountainous; and from the nature of their damp and chilly climate, no grain of any kind will come to perfection. They are, however, covered with pasture, and the inhabitants depend for subsistence on their sheep, and on the numerous birds which frequent the rocky shores of these islands.

Iceland may be considered as one of the most extraordinary territories in Europe, as it is situated on the very borders of the arctic circle, and covered with mountains ranging from 3000 to 6000 feet in height, and consequently, in this high latitude, capped with perpetual snow; whilst almost every part of the island exhibits indications of energetic subterranean heat, which is openly developed in many parts, in the phenomena of volcanos, caldrons of boiling mud, and boiling fountains. Hecla, though the most noted mountain, or yokul (as they are locally termed), is by no means the loftiest summit,—the yokul or jokul of Oefere rising to the height of 6240 feet above the sea.

No trees grow upon this island; but the occurrence of *surturbrand*, and other kinds of fossilized wood, appears to indicate that, at some remote period, forests may have occupied its soil. At present, however, the inhabitants are dependent for their supply of timber on the drift wood cast upon the coast. Nor is this insignificant in amount; for by a provision no less remarkable than admirable, the currents of the ocean, which set in upon this island, deposit upon its shores vast stores of uprooted trees borne thither from some more genial clime. The pastures in some parts of Iceland are very good, but in others so scanty, that the poor people may be seen on their knees, scooping out, with a clasp knife the few blades of grass which spring up between the interstices of the rocks, as fodder for their cattle. The only grain capable of cultivation is barley, and that merely in a few favoured spots. The species of lichen called Iceland

moss (fig. 217), occurs abundantly. And among the animal inhabitants of this island, the eider duck (fig. 136) is one of the most important.

Situated wholly within the arctic circle, rises the dreary territory of Nova Zembla, or Novaia Simlia. The land on the western side is mountainous, and some of the summits reach the elevation of 3500 or 3800 feet above the level of the sea; but the shores on the eastern side are described as generally low, and presenting a desolate and monotonous appearance. Though generally little penetrated with inlets or sounds, one, which runs east and west, reaches entirely across, dividing the territory into two nearly equal parts.

We have before mentioned that Nova Zembla is considered to form part of a barrier which arrests in their westward course, the masses of ice borne down by the great Siberian rivers, and which is to a great degree, instrumental in moderating the climate of Western Europe. It will, however, be readily conceived that, useful as this mass of land may be in this respect to other territories, its own temperature will suffer from these chilling influences. And accordingly, we find the natural productions of Nova Zembla bearing testimony to the ungenial nature of its climate, this territory being described as even more dreary than Spitzbergen, though the latter is considerably further north. Surrounded as it is by the waters of the Arctic Ocean, Nova Zembla, however, possesses an insular climate, neither suffering such intense cold as some approximate continental regions, nor on the other hand, enjoying so much compensating summer warmth; circumstances, the latter especially, which greatly influence and abridge the number of its natural productions.

Although by no means absolutely destitute of either animal or vegetable life, Nova Zembla displays, in a striking degree, all the characteristics of an arctic region; and this scene has been so forcibly depicted in the recent remarks of M. von Baer, that we cannot do better than avail ourselves of his description.

"The total want, not only of trees, but also of every kind of shrub large enough to attract the eye, gives to polar landscapes

a peculiar and deeply impressive character. In the first place all power of measurement is lost to the eye. From the want of the usual objects of known dimensions—trees and buildings—distances appear much less than they are. Nor does this deception seem to depend solely on the absence of familiar objects, but also on a peculiar transparency of the atmosphere; so that the mountains apparently approach quite near, and are consequently at first considered to be much lower than they actually are.

"Another effect of the want of trees, and even of a vigorous growth of grass," continues M. von Baer, "is the sensation of loneliness, which seizes not only upon persons of reflection, but even on the roughest sailor. It is by no means a sensation of fear, but rather a solemn and elevating one, and can only be compared with the mighty impression which a visit to Alpine regions always leaves behind."

. . . The feeling infinite; so felt
In solitude, where we are least alone,
A truth which through our being then doth melt,
And purifies from self

The impression produced on M. von Baer's mind by this peculiar stillness was, that the morning of creation was dawning for the first time, and that life was yet to follow; an idea which, when once conceived, he found it impossible to repress.

In other regions, the leaves of tall plants and trees, usually, by their rustling, give indications of the slightest breeze; but in this land of silence, unless the wind be high, it does not ruffle the lowly plants which there find their habitation. "One might take them to be painted."

We have already spoken of the decrease in the number of species of insects, as we recede from the equator, and, that ten species constitute the whole of the known insects of Nova Zembla; but what is yet more remarkable, these also are noiseless. "On sunny days and in warm spots, a humble-bee is sometimes seen flying about the small projecting points of rock, but it hardly hums. Flies and gnats are rather more numerous; but even these are so rare, so peaceful, and languid, that in order

to see them they must be sought for." The languor of the latter insects was shown by their not inflicting a single bite on the newly arrived visitors, who appear almost to have longed for a gnat bite, "merely for the sake of perceiving life in nature." The exceeding rarity of insect life is, however, perhaps most strikingly manifested in the circumstance, that even in carcases left on the shore, no insect larvæ are found.

The larger animals inhabiting this territory, consist of the polar bear, seldom, if ever, seen in summer, a very few rein-deer, a small number of wolves, and common foxes, with a rather larger supply of polar foxes, and of lemmings. These animals, however, rarely disturb the stillness of the scene, for, with the exception of the very rare rein-deer and the lemming, they are all nocturnal: the lemmings even, which burrow under ground, "coming forth from the earth, and gliding along in straight lines, and then again vanishing into it, appear like spectres;" the propensity peculiar to this animal of moving in straight lines, according remarkably with this singular scene, and rendering its appearance little calculated to disturb the general monotony.

The only land birds known to inhabit Nova Zembla are, the snow bunting, the great snowy owl, and a species of falcon; but the shores, owing to their proximity to the continent, become in the summer season, the resort of vast numbers of sea-birds. These coasts are also peopled with various tribes of sea mammalia, including the walrus, three species of seal, the dolphin, and occasionally the narwhal, or sea unicorn.

Spitzbergen, called also East Greenland, consists of an assemblage of ice-clad islands, the general aspect of which is gloomy and sombre, through picturesque. The shores are rugged and bold, in many places consisting of lofty and inaccessible rocky cliffs, bare and black, towering to a considerable elevation, whilst the entire face of the country is dreary, diversified only by mountains, with sharp-pointed summits, some of which exceed 4000 feet above the level of the sea. The long duration of sun-light causes the snow on these summits to be melted in summer; but the valleys never loose their icy

coverings, and glaciers of immense size and magnificence are formed.

Yet even this inhospitable climate is not utterly destitute of vegetation, some plants being found which brave the rigour of almost perpetual frost; but as will be anticipated, they are of minute size, and generally present a crabbed and wretched appearance. The dwarf willow, the most vigorous of all, here scarcely rises *two inches* above the ground. The remaining plants consist of the cochlearia, ranunculus, some species of saxifrage, &c., and several kinds of lichen.



The principal animated inhabitants of Spitzbergen are the polar bear, polar fox, and some other animals, whose range extends along the arctic circle. Its shores abound with the walrus, seal, and other marine mammalia; and its seas were at one period remarkably prolific in the Greenland whale, but these have been chased from their ancient station by the rapacity of man, and have almost deserted the vicinity of Spitzbergen.

CHAPTER XIV.

CENTRAL LINE OF MOUNTAINS IN ASIA.—ASIA MINOR.—SYRIA.—PALESTINE.—ARABIA.—ARMENIA.—CAUCASUS RANGE.—PERSIA.

. . . . . Here thou behold'st
Assyria and her empire's ancient bounds,
Araxes, and the Caspian Lake; thence on
As far as Indus east, Euphrates west,
And e'en beyond to south the Persian bay,
And inaccessible th' Arabian drouth.—MILTON.

THE Grand Central Axis, in its continuation across the vast regions of Asia, next demands our attention. We have traced the Balkan range to its termination on the extreme borders of Europe, and we find the central line prolonged in Asia Minor, by the extensive mountain system of the Taurus, which covers a large portion of the peninsula of Asia Minor, or Anatolia.

The Taurus range bears, in Mysia, the ancient names of Ida and Temnon; and in Phrygia and Bithynia, it forms the range of Olympus; whilst in its continuation in Paphlagonia, it is distinguished by the name of Olgassys. The name of Taurus is more restricted to the lofty ranges which traverse the southern portion of Asia Minor, from which many lateral branches extend. In this part is situated the extinct crater of Mount Argeus, rising up abruptly from a broad extended base, to the elevation of 13,100 feet above the level of the sea.

The mountain ranges of Asia Minor support an elevated plateau, or table land, which occupies all the central districts, presenting a succession of extensive and fertile plains, possessing, from their height above the sea, a cool and temperate climate. Between the mountain ranges and the Black Sea, a narrow strip of low land occurs, on an average about twenty-four miles in width, and covered with dense forests, which extend up the declivities of the mountains, to the elevation of



about 4500 feet above the sea. This mighty mass of trees is known to the Turks by the significant appellation of Agatch Degnis, or "the sea of trees." The scenery on this coast is described as highly beautiful and picturesque, presenting, especially in its eastern limits, one continued garden of azaleas, rhododendrons, and myrtles; whilst, in the rear of "the sea of trees," rise the mountain crests, to the height of 5000 or 6000 feet.

The vegetation of this region is rich and varied, and Asia Minor forms the original habitation of a large number of valuable plants, now almost naturalized in Southern Europe. The pine, fir, and juniper, occupy the most elevated spots: we here also meet with the cedar of Lebanon; whilst evergreen oaks, as well as some deciduous species, are peculiarly abundant. The beech also prevails in Caramania, Bithynia, Paphlagonia, Pontus, and Colchis; in which districts many of our fruit-trees, such as the plum, cherry, apricot, almond, medlar, quince, apple, pear, chesnut, mulberry, fig, and vine, are met with, growing wild in the heart of the forests. Vast tracts are also covered with olive, myrtle, and arbutus, laurels, pomegranates, pistachio nuts, rhododendrons, &c.; whilst the ground is adorned with the hyacinth, tulip, garden ranunculus, and several kinds of iris.

The mountains of Amanus diverge from the Taurus range, which they connect with that of Lebanon. The latter range traverses the whole of Syria, towering to a considerable elevation; many of the summits being covered with perpetual snow. In its southern course, this range forms two branches, known to the ancients as Libanus and Anti-Libanus, which enclose a broad valley, familiar to the student of ancient history, as Cœlo-Syria. On the declivities of the mountains of Lebanon, are still found a small number of the long-celebrated cedars of Lebanon, which, in the days of king Solomon, were so abundant, but which, in 1836, did not, (of large size,) exceed four hundred in number.

The plains of Syria, and more especially those in the southern districts, are celebrated for their beauty and fertility:

their vegetation resembles that of Palestine; but in the northern districts, near Aleppo, the date, orange, and lemon, will not succeed without shelter, which arises from the excessive climate of this part, the winters being sometimes severe, though the summers are extremely hot. The damask rose, once well known as a choice ornament of our gardens, though now nearly superseded by modern varieties, is supposed to have been originally brought from Damascus at the time of the Crusades.

Judea now, and all the Promised Land.—MILTON.

The mountains of Palestine diverge from the range of Libanus, but are by no means elevated, Judea being rather a hilly, than a mountainous, country. Its principal eminences, Carmel, Tabor, and Abarim, do not rise in bleak and rugged peaks, but present picturesque and gradually rising hills, the slopes of which are adorned with vineyards, whilst they are clothed to the summit with luxuriant woods and the richest pastures; and the clefts of the rocks are inhabited by innumerable bees, so that they may almost literally be said to flow with milk and honey. The valleys of Judea are exuberantly fertile;

Where stately Jordan flows by many a palm,
Or where Gennesaret's wave
Delights the flowers to lave,
That o'er her western slope breathe airs of balm.

Of a far different character is the desolate territory in the neighbourhood of Lake Asphaltites, or the Dead Sea, where the surface is only varied by fearful precipices, so lofty as to exclude the rays of the sun from the deep and dreary glens they enclose; whilst the massive rocks, apparently rent and shattered by some mighty convulsion, assume a thousand fantastic forms. Among these wild and rocky fastnesses, numerous deep caves occur, which, under the first dispensation, served as places of refuge to the persecuted prophets and people of God, and which, in later times, also sheltered the Christians of the East.

Judea having been the land selected by the Most High for the abode of His chosen people, and being described in Holy Writ as a "a good land," we are naturally led to inquire in what its peculiar excellency consists. Nor will the reply prove unsatisfactory; for we shall perceive, that this country is no less distinguished for its great fertility, than for possessing a climate singularly adapted to favour the luxuriant growth of the most important vegetable productions, both of temperate and of hot regions. Bordering, as this land does, upon the Mediterranean, or "Great Sea," and traversed by hills of sufficient elevation to attract moisture, though not so high but that they admit, in this latitude, of cultivation to their very summits; it enjoys a sufficient supply of rain to ensure its fertility, whilst in the months when those are suspended, copious dews water and refresh the thirsty land. The inequalities of its surface, at the same time, favour the growth of the various vegetable productions of different zones, some of which succeed in the low plains and valleys, and others in the more elevated districts. From Tripoli to Sidon, the country is much colder than the rest of the coast further to the north and to the south, and its seasons are less regular. The same remark applies to the mountainous parts of Judea, where the vegetable productions differ from those on the sea-coast. Owing to their greater elevation, again, some parts of Galilee are very fresh and cool; though at the foot of Mount Tabor, and in the plain of Jericho, the heat is intense.

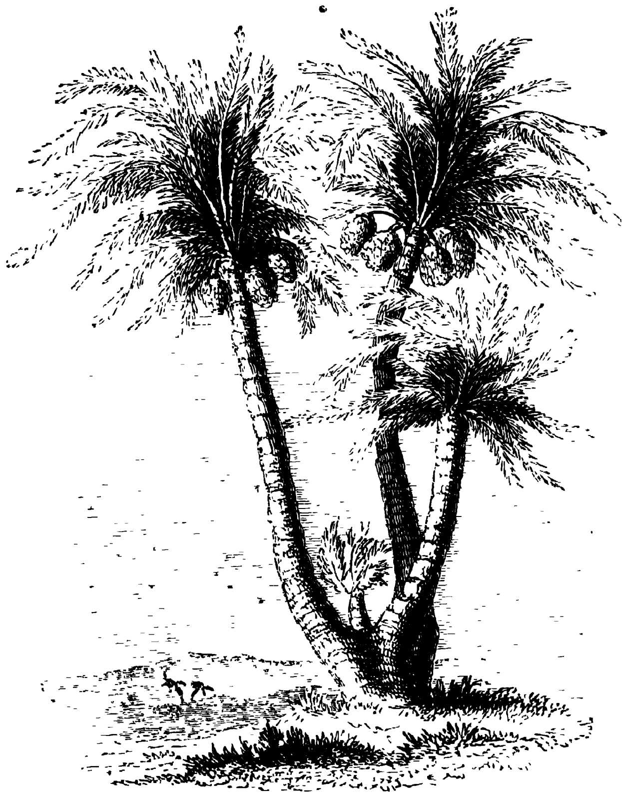
Wheat, barley, rye, beans, maize, rice, dhoorah, and sesamum, all flourish in this territory; but there is much reason to believe that the latter grains are comparatively modern introductions, and that the "parched corn" of the country, of which the children of Israel partook on the day the manna ceased, was of that description distinguished among us as bread-corn. According to the representation on an ancient Jewish coin, it appears that the wheat at that period cultivated in Palestine, though perhaps a bearded wheat, was not the Egyptian species.

We here also meet with the greater number of forest trees,

already mentioned as occurring in Southern Europe, and all the fruit trees which adorn those regions, such as the orange, citron, pomegranate, mulberry, fig, olive, pistacia, and vine; together with the tamarind, date, and plantain. But it is not the mere occurrence of these various plants, but rather the superiority they here attain, which renders this region remarkable. The olive trees and pomegranates grow to an unusual size, and the figs are of the greatest excellence; but the most distinguished among the vegetable productions of Palestine are the vines. And not only are these plants of extraordinary size in this region, but the bunches of grapes are described by modern travellers as weighing from ten to twelve pounds, and the grapes as of the size of plums. Of similar character may have been the cluster of grapes brought from the brook Eshcol, by the men who were sent from Kadesh to spy the land: and thus literally, do we find this country to be "a land of wheat, and barley, and vines, and fig trees, and pomegranates; a land of oil-olive, and honey;" an "exceeding good land."

In consequence of the size and peculiar excellence of the fruit of the vine in this country, it has been supposed to be the aboriginal habitation of that plant. However this may be, (and it is a question very difficult to solve,) the vine is now found flourishing without cultivation in Judea, though by no means solely in that territory; for it will be remembered, we have already met with it in other regions. These vines which grow wild, are, however, totally distinct from the "wild vines," and "wild grapes," spoken of in various parts of Scripture; and the latter are supposed to be a species of nightshade, the *Solanum sodomæum*, producing fruit, probably of tempting appearance, but of poisonous nature. This plant, at the present day, grows on the shores of the Dead Sea, and its fruit is subject to be internally destroyed by an insect; so that, although it retains its form and colour, it contains nothing but dust. And it may be reasonably inferred that this is the plant spoken of by ancient authors as bearing

'. . . The apples on the Dead Sea's shore,'
All ashes to the taste.



Date Palm Tree.—Phœnix Dactylifera

The terebinth tree, or Pistacia terebinthus, which we have before met with in Southern Europe, and especially in the islands of Greece, is a native of Palestine, and is considered to be the species of tree rendered "oak" in our translation of the Bible. It is from these trees that the Terebinthine Vale, or Valley of Elah, obtained its name: a spot renowned in sacred history as the scene of David's victory over Goliath. "The husks," which, in the beautiful parable of the Prodigal Son, we read, "that the swine did eat," are supposed to be those of the carob, or Eastern locust tree, which are still commonly employed in Palestine for feeding cattle. The sycamore tree of Scripture, (into which Zaccheus climbed, and of whose fruit the prophet Amos describes himself as "a gatherer,") differs totally from the species of maple commonly known by that name in our country, and is, in fact, a species of fig tree; bearing a sweetish, watery, and somewhat aromatic fruit, which comes to maturity at various seasons of the year. The palm tree of Scripture is the date palm, which in Palestine forms groves of exceeding beauty; and the "palm branches" which the people took, when they went forth to meet our Lord, on his triumphant entry into Jerusalem, were the leaves, or fronds, of this valuable tree.

Ancient and modern writers combine in rendering testimony to the beauty and fertility of this land. Tacitus speaks of the fruitfulness of the soil, exuberant in its produce, like that of Italy, and yielding the palm and balm tree. Justin also speaks of the exuberant produce of Palestine, and its beautiful climate. "Under a wise and beneficial government," says Dr. Clarke, "the produce of the Holy Land would exceed all calculation. Its perennial harvest, the salubrity of its air, its limpid springs, its rivers, lakes, and matchless plains, its hills and vales,—all these, added to the serenity of its climate, prove this land to be indeed 'a field which the Lord hath blessed: God hath given it of the dew of heaven, and the fatness of the earth, and plenty of corn and wine.'"

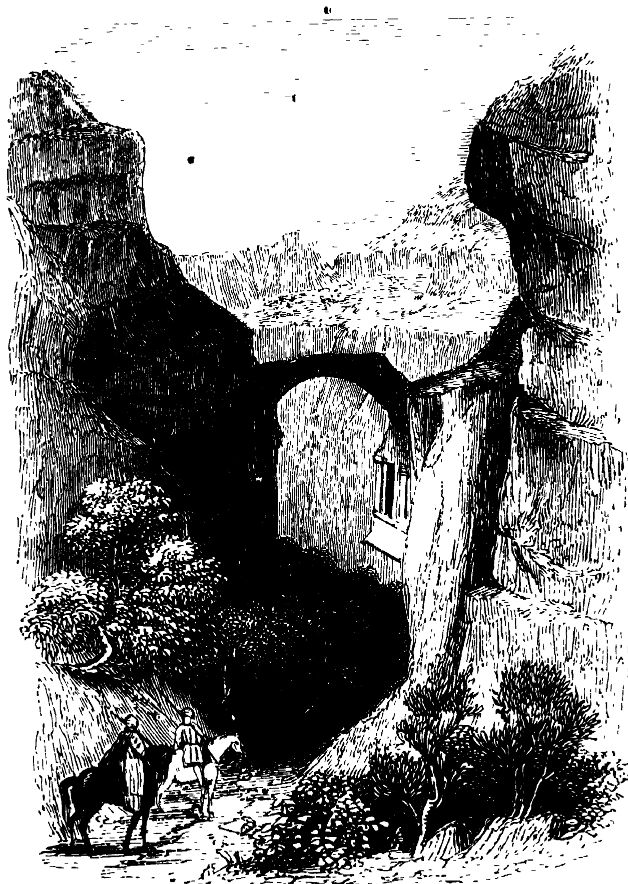
Beautiful and fertile as was the land of Judea, it was not without some attendant natural evils, which, in the language

prophecy, are often introduced, both as threatenings of punishment to the disobedient, and as types of still greater calamities. Earthquakes, volcanos, drought, whirlwinds, the pestilential simûn, and the devastation of locusts, have all at various periods visited this country. The latter, emphatically termed the "army of the Lord," sometimes appear in countless hosts, occupying a space of two or three miles in length, by a mile and a half in breadth, and in such dense masses as to obscure the light of day.

The lion was anciently common in this territory; but this formidable animal appears to be unknown at the present day in this part of Asia. In a country so anciently, and so populously inhabited, as was Palestine, the native animals become in great measure lost to our view, and superseded by domestic species. Sheep, goats, oxen, camels, and asses, appear to have been included among the latter from the remotest antiquity; whilst among the wild animals, were the roebuck, antelope, hare, coney, jerboa, chamæleon (fig. 146), &c., &c.

To the south of Palestine lies the mountainous and desolate tract of Idumea, or the land of Edom, now included in Arabia Petrea, forming a strong contrast to the fertile regions we have just been considering. And yet, this land appears also to have been highly productive in ancient times. It is not, however, impossible, that its former fertility may, in great measure, have been attributable to the high state of cultivation in which every part seems to have been maintained, in its days of prosperity. Be this as it may, the whole country is now nearly desolate, and its once flourishing cities laid in ruins, and almost without an inhabitant. This territory is remarkable for its bold and precipitous rocks, in the clefts of which, its ancient inhabitants made their dwellings. The remains of the works of man, found in this region, fully attest its ancient importance, and the remarkable change which has occurred in its condition; also, its natural features are of a description to strike the beholder with awe and amazement. The narrow defile by which the now desolate city of Petra* is

* In Scripture called Bozra.



Approach to Petra.

approached, may convey some idea of the character of the scenery.

Of a very similar character, is the peninsula in which the Wilderness of Sinai is situated, and where we meet with the holy Mounts of Horeb and Sinai. The Wilderness of Sinai is described by M. Laborde, as "one of the most singular scenes that imagination can picture." A deep valley, or ravine, fifty paces in width, shut in by immense masses of granite, often rising perpendicularly to the height of from one thousand to twelve hundred feet, with huge fragments scattered at their base, assuming the most extraordinary forms, and presenting caverns and fissures of fearful aspect. The country at the foot of Mount Horeb, is equally wild; and the whole district, from thence to Ezion Gaber, consists of a frightful desert, appearing like a troubled sea, suddenly petrified.

Although Arabia contains some fertile *wadys*, or narrow well-watered valleys, the general character of the country is that of bare rocks and barren sands. The deficiency of moisture, combined with the high temperature incident to its situation, within or near the tropic of Cancer, may be considered as the cause of this desert character. Its deficiency of moisture may in great measure be attributed to the position of its mountain ranges, and the nature of its soil. The former, generally speaking, are not of great elevation, and do not form a ridge through the centre of the country, but encircle it in those parts where it borders on the sea; the consequence of which is, that the vapour becomes condensed and deposited on these mountains; and instead of falling in fertilizing showers in the interior, rushes down in torrents rather than rivers, from the mountains and rocks, and after diffusing verdure over valleys of small extent, all the moisture is lost and absorbed in the sand. The interior of the country is, however, little known.

The coasts bordering on the Red Sea present ranges of barren mountains where, generally speaking, not a trace of vegetation is to be seen. The southern coast is little less dreary; but the mountains in that part of Arabia, recede

further from the coast, leaving a broad plain, in which is situated a remarkable belt of low sandhills, which are so loosely held together, that they change their outline, and even shift their position with the prevailing wind. These hills rise in sharp ridges, and are all of a horse-shoe shape, a form which appears to be usually assumed by sandhills of this description; and, notwithstanding their liability to change their position, they are not wholly destitute of vegetation; a few stunted acacias being met with, and also the arak tree, which adorns with its lively green foliage this, and some other of the most desolate regions of the earth. In the south-eastern districts, near the town of Muscat, the mountains rise abruptly from the sea; but in their northern course through the province of that name, they leave, between their base and the sea, a tract occupied by numerous ravines and valleys, which display the richest vegetation, being adorned with noble forest trees, and with luxuriant groves of almond, fig, orange, citron, and other valuable trees. This range of mountains, from the fertility of these valleys, has acquired the name of Jebel Akdar, or the Green Mountains. The highest summits in this range reach the elevation of six thousand feet above the level of the sea.

To the westward of the Jebel Akdar, extends the Great Sandy Desert, unvarying and desolate in its appearance, and apparently occupying a considerable surface in the interior of the country. The district to which the designation of Arabia Felix has been applied, appears little deserving of that name, an almost continual drought rendering this part generally unfit for cultivation; and the dhoorah is almost the only grain which succeeds. Indeed, "Araby the Blest" appears rather to have acquired this appellation, from having been the emporium and channel of transporting into Palestine and Europe, various spices and odoriferous gums, as well as other valuable articles brought from India and Eastern Africa, than from its possessing any such products peculiar to its own soil, of which, nevertheless, they were long considered natives. Turquoises, however, are very abundant in Arabia Petrea; and the other districts produce some valuable gums.

The indigenous vegetable productions of Arabia are comparatively little known. In a considerable portion of this territory, indeed, it appears that

Green, smiling nature's universal robe,

is in great measure put off, grasses being very scanty, and rushes nearly unknown; whilst cryptogamic plants, whose existence depends so much on moisture, seem to be wholly wanting. The forest trees are confined to the mountains and the adjacent valleys. Among these, the most numerous are various species of fig trees; but one of the most conspicuous is the *Keura odorifera*, a superb tree, in some respects resembling a palm, and much prized on account of the delicious and powerful odour it exhales. The Acacia arabica (fig. 72), from which gum arabic exudes, may also be ranked as a native of this country. Gourds of various species (plants in which the camel especially delights) are abundant in the more fertile districts; whilst the more sterile sandy parts produce the gharkad, which is a thorny shrub, bearing a small red berry, very juicy and refreshing, and much resembling a ripe gooseberry. This fruit arrives at perfection in the height of summer, when the ground is parched up; "exciting," says Burkhardt, "an agreeable surprise in the traveller, at finding so juicy a berry produced in the driest soil and season." In some parts of the coast bordering on the Red Sea, a narrow sandy tract occurs at the base of the mountains, distinguished by the appellation of Tehâma; and in this district, palms form the prevailing trees. Among its cultivated plants, Arabia includes many of considerable importance. One of the most prominent of these is coffee, which, though not considered to be a native of Arabia, arrives at its highest perfection in the most favoured parts of this region. This plant grows to the height of forty or fifty feet, with a stem four or five inches in diameter, and is cultivated on artificial terraces, on the slopes of the mountains. Arabia produces balsam, frankincense, myrrh, and other odoriferous gums; though, as we have just seen, the plants from which they are obtained are not considered indigenous to this country. Balsam, or balm, is the

produce of the *Amyris opobalsamum*; myrrh of the *Amyris kataf* (fig. 46). Frankincense is obtained from the *Juniperus lycius* (fig. 163), though this is of inferior quality, the true frankincense, or olibanum, being the produce of the *Boswellia serrata*, an East India plant, and unknown in Arabia. The beautiful tamarind tree (fig. 70) is cultivated for its valuable fruit; and date palms are very abundant; whilst in the southern districts, we meet with the cocoa-nut palm. In the latter portion of this territory, stapelias, mesembryanthemums, and other African genera, make their appearance; and aloes are very numerous, six different species being known as inhabitants of Arabia, among which is the splendid *Aloe soccotrina* (fig. 191), the native habitation of which appears to be the small adjacent island of Soccotra.

The native animals of Arabia include monkeys, panthers, lynxes, hyænas, the jackal, jerboa, hyrax, or coney, &c. The principal domesticated animals are the celebrated Arab horses, (which, however, are not considered as aboriginal natives of this country,) and the Arabian camel, or dromedary (fig. 81). Locusts of various species periodically visit and devastate Arabia. These insects form an article of food with the natives, being commonly exposed for sale in the markets; they are considered wholesome and nutritious.

It will now be desirable to return to our grand central line, which we find prolonged in the elevated plateau of Armenia. This remarkable highland, between Trebizond and Mósul, has a width of 360 geographical miles*, preserving a general level of six thousand feet above the sea; but towards its southern termination, the mountains of Juwar Tagh are said to reach the elevation of fifteen thousand feet, and from thence the descent is almost abrupt, to the low level plains of Mesopotamia. This highland has, as will be supposed, its elevations and depressions; thus, Erzrúm is seven thousand feet above the sea, and consequently possesses a cold climate; whilst the fine plain, in which Mush is situated, which is 4700 feet above the sea, is one of the richest in the Turkish dominions; and

* About 413 statute miles.

the remarkable valley of Bitlis, is little more than three thousand feet above the sea level. This valley, which is entered by three ravines, is filled with orchards, and irrigated by numerous streams and springs; whilst bare limestone mountains rise on every side to the elevation of about two thousand feet above the valley, in the centre of which stands an abrupt rock, about sixty feet in height, crowned with an ancient castle; "the whole," observed Mr. James Brant, who visited this spot in 1838, "combining to form a prospect as singular as interesting." In the highland of Armenia is situated the salt lake of Van, which is 5470 feet above the sea. On the shores of this lake, rises the mountain of Supan Tagh, 9500 feet above the sea, and full 4000 feet above the lake.

In this elevated land, are also situated the wild and picturesque mountains of Lázistán, which are chiefly composed of volcanic rocks, forming in one part an entire mountain of the beautiful volcanic glass, called obsidian. These mountains are singularly wild in their character, with high perpendicular cliffs and terrific gorges, interspersed, however, with beautiful and picturesque valleys, adorned with almost every species of the various fruit trees met with in temperate zones, growing in the utmost perfection. The general character of these mountains is, nevertheless, bleak and rugged, and several of the summits attain a great elevation above the sea, being covered with perpetual snow.

Continuing our course to the eastward, the beautiful peaks of the Greater and Lesser Ararat burst upon our view. The whole country in this vicinity, is full of traditionary stories relative to Noah's ark and the Deluge; and the Armenians, as soon as they see Ararat, kiss the earth, and repeat certain prayers. They call it "the Mountain of the Ark;" and the Persians designate it as "the Mountain of Noah." The height of this imposing and snow-capped mountain is 17,260 feet above the level of the sea*. Mr. Hamilton, who visited

* The convulsions which have recently occurred in this mountain will be noticed in a future page.

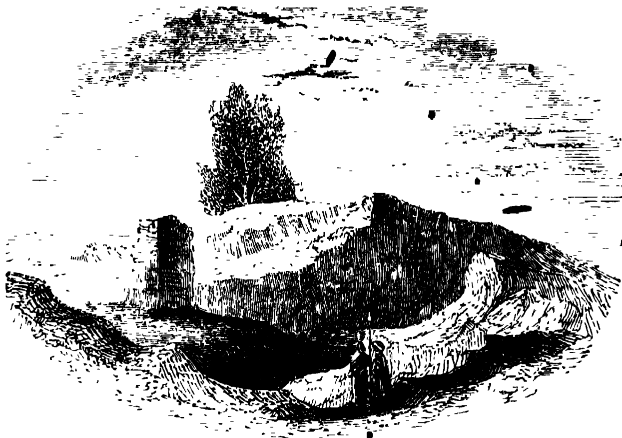
this spot in June, 1836, says, "It is impossible to describe the effect produced by the first view of this stupendous mountain, rising in majestic and solitary grandeur, far above the surrounding hills and mountains. The morning was beautifully clear, the sun had just risen, and not a cloud, or particle of vapour, obscured its striking outline: and it was impossible to look on this mountain, so interestingly connected with the early history of the human race, without mingled feelings of awe and wonder." The Greater Ararat is covered with perpetual snow, but the Lesser Ararat loses its icy covering in summer. Mount Ararat is considered to be of volcanic formation; indeed, the whole country appears to rest on a basaltic base.

Mount Sevellan, the height of which is 13,000 feet above the sea, is the most elevated summit in this district next to Ararat; and like that, seems to consist of the cone of an extinct volcano, being supposed to have been more recently in a state of activity, than any other in this territory.

The whole of the region we have now been considering is remarkable for the abundance of fruit-trees which grow in its plains and valleys; indeed, the country on the western banks of the Caspian, is supposed to have formed the original habitation of most of our choicest fruits; and it is from hence that the apricot (fig. 62) has obtained its name of *Prunus armeniaca*. In the low plains of Mesopotamia, watered as they are by the Tigris, the Euphrates, and their tributary streams, vegetation flourishes luxuriantly; and the date-palm winds along the course of these rivers, extending to Bagdat on the one side, and overshadowing the ruins of Palmyra on the other. The banks of the Tigris beyond Bagdat, are fringed with cucumbers (fig. 19), and with weeping-willows (fig. 108), which also still shade "the waters of Babylon." It is not a little remarkable, that, desolate, and converted into a heap of ruins, as is the once "great Babylon," some apparent vestige of its celebrated hanging gardens should yet remain. This consists of a solitary tree, a species of tamarisk, not considered a native of this region; but which still possesses a



verdant top, and occupies a ridge near the ruins of an ancient palace.



The [illegible] Tree on the Ruins of B[illegible]

In the higher parts of the plateau of Armenia, a totally different climate prevails, from that experienced in the low plains; its great elevation above the sea, rendering the climate cold, and in some parts even severe, and therefore totally unfavourable for the growth of plants of warmer regions. Thus, at Erzrúm, the ground is seldom free from ice and snow until the middle of April, and snow sometimes falls in the month of June.

The Grand Central line is next continued in the range of mountains which extends along the western shores of the Caspian Sea, forming the boundary of the vast plains of Bucharia, and which is historically famous for containing the Bactrian, Parthian, Hyrcanian, and Caspian mountain passes; these ranges being now known as the Elburz, or Elburj, and Parapomisan Mountains. The summits of the Elburj do not generally exceed 7000 feet, but the loftiest peak, Mount

Demavend, a volcanic cone, is, 14,700 feet above the level of the sea. The Parapomisan range does not appear to present any very elevated summits, but gradually blends it with the vast mountain mass of the Hindoo Koosh, or Hindoo Koh; the latter being an extensive Alpine region, which we may consider as a knot in our grand central axis; for, from that point, diverge all the vast mountain ranges of Asia. But since the Hindoo Koosh, as its name indicates, may be considered as belonging to the Indian mountain system, it will be desirable before proceeding to any description of its features, to retrace our steps, and turn our attention to the principal ranges diverging from that portion of the central line which extends from the borders of Armenia, to those of Hindostan.

The most remarkable of these, if indeed it can be considered as connected with our central line, is the lofty and extensive range of Caucasus. The central portion of these mountains is entirely composed of porphyry, and is described as consisting of a plateau, 8000 or 10,000 feet above the sea, which is rent in every direction by deep and narrow valleys, and traversed cross-ways by a ridge of rugged and picturesque rocky eminences, the summits of which are covered with perpetual snow. The highest point is Mount Elbourz, 16,500 feet above the sea, situated on the northern border of the highly fertile and beautiful country of Georgia. The latter country is, perhaps, scarcely exceeded, in the richness and variety of its vegetable productions, by any region in the globe. Watered by numberless streams flowing from the elevated range of Caucasus, and screened on the north by those mountains, the plants of tropical climates succeed in its valleys, whilst those of temperate regions flourish luxuriantly in the more elevated plains, and the sides of the mountains are adorned with magnificent forests of beech, ash, chesnut, oak, and pine. Between Georgia and the Black Sea, is situated the ancient Colchos, now called Mingrelia and Imiretta. The interior of this tract is mountainous, but the lower parts, near the Black Sea, are remarkable for their humidity. Innumerable streams flow down into this territory from the

Caucasus range, and, uniting their waters, form no less than thirty considerable rivers. This redundant moisture renders the soil and climate unfit for cultivation, but fruit-trees of every description grow spontaneously; though some species of fruit are affected by the moisture of this region, and are more juicy than well flavoured. Chesnuts, figs, and grapes, are, however, very fine.

The animals inhabiting the Caucasian regions include the lynx, a small species of tiger, the bear, urus, chamois, a species of ibex, and several antelopes.

Extensive mountain branches diverge to the south of the grand central line, constituting the mountain systems which support the table-lands, lying between the plains of Mesopotamia and the River Indus. At their western extremity, Koordistan presents a vast succession of hill and valley, dell and plain, of the greatest fertility, flanked by mountains of towering elevation; the summits of the great range of Zagros, which runs nearly parallel with the Euphrates and Tigris, rising to an elevation exceeding 14,000 feet above the level of the sea. The "colossal Goodrun" is said to contain a glacier, affording an inexhaustable supply of ice, with which it furnishes all Koordistan. The eastern support of this plateau is formed by the range of Solmaun, which diverges from the central line, near the Hindoo Koosh; and its southern boundary is formed by the mountains of Beloochistan.

The elevations of the plains of Persia above the level of the sea, (about 4000 feet,) renders the climate mild, and adapted to the growth of plants of temperate regions; and accordingly, we find the currant, cherry, apricot, peach, and others of our well-known cultivated fruit-trees, flourishing in these plains, the peach having been obtained from thence. The celebrated wine of Shirauz bears testimony to the perfection attained by the vines of Persia; roses also grow luxuriantly, appearing in the form of trees. The cypresses of Shirauz, so famed in Oriental song, have almost entirely disappeared, having been unmercifully cut down for common carpentry, doors, window-frames, &c. The whole of this territory is, however, by no

means equally fertile. Instead of being traversed by a mountain-ridge we have seen that it is surrounded on all sides by elevated ranges: these arrest and condense the moisture, and the consequence is, that the interior of the country (in the centre of which there is a considerable depression) is arid; and it is only in the districts bordering on the mountains, that any streams occur, or that this great fertility prevails. The vegetable productions of Cabool, which forms the north-eastern portion of this table land, are very similar to those of Southern Europe; the uncultivated plains being covered with mulberry, Oriental plane, poplar, and several species of willow, and the mountains with various species of pine and fir. A flat district extends between the mountains of Beloochistan and the sea, which is very sultry, but favourable to the growth of the palm, mango, guava, and other tropical plants.

Among the native animals of Persia, are the spalax, or blind rat; the brown rat, improperly called the Norway rat, but which originally came from this part of Asia; the dorcas antelope; Persian gazelle, with its "soft black eye;" fallow deer, common hare, brown bear, lion, ounce, &c., &c. Its domestic animals include both the Bactrian camel and the dromedary; and the Persian horses rank second only to those of Arabia.

CHAPTER XV.

THE HINDOO KOOSH.—HIMALAYAH MOUNTAINS.—CHINA.—INDO-CHINESE COUNTRIES.—HINDOSTAN.—ISLANDS OF ASIA.

. . The mountains huge appear
Emergent, and their broad backs upheave
Into the clouds, their tops ascend the sky.—MILTON

THE mighty Alpine system, to which is applied the name of Hindoo Koosh, or Indian Mountain, forms the commencement of the vast Indian range, which bounds Hindostan on the north,

and extends to the most eastern valleys of Assam or Asam—a distance of nearly 2000 miles. The general elevation of the Hindoo Koosh is very great, and a considerable number of summits in this group are covered with perpetual snow. The most lofty known point, reaches the height of 20,500 feet above the level of the ocean. The mountains in this range are intersected by some fertile valleys, but their declivities are in general destitute of trees. Barley succeeds at the elevation of 10,000 or 11,000 feet above the sea; and human habitations are met with at about the same level, though the occupiers of these dwellings are, during six months of the year, prevented by the deep snow from quitting them.

The range of the Tibet Panjahl, connects the Hindoo Koosh with the stupendous Himalayah Mountains. The highest points in the Tibet Panjahl, are Mer and Ser, which are both pyramidal mountains, the one black and the other white, situated near each other, and rising in almost unparalleled majesty above the boundless regions of snow, formed by the inferior summits of this range.

The pre-eminently lofty and extended Himalayah Mountains take a south-easterly course, and terminate at the River Brahmapootra, from whence the central line is continued in the Harpala range, which connects the Indian mountain system with that of China. The number of snow-clad summits in the Himalayah range is exceedingly great, and among these, we meet the most elevated summits on the surface of the globe. Dhawala-giri, or the White Mountain (Plate I. fig. 1), is, as far as at present known, the highest point, and attains the elevation, of 26,852 feet above the sea. Other summits of at least equal height, are, however, supposed to exist, but these yet remain unmeasured. Beyond the peak of Chumalari, which has an altitude of 25,000 feet, the range takes a nearly due easterly direction for about 200 miles, then, turning to the north, terminates in the mountains which form the source of the Brahmapootra River. This portion of the range also contains a vast number of snow-crowned peaks, but towards its eastern limits, it appears to decrease in elevation. The height

of these mountains has not, however, been distinctly ascertained; and the ranges which connect them with those of China are yet less known.

China is a very mountainous country, half its surface being occupied with mountain ranges, in many parts too steep to admit of cultivation, but which are covered to a considerable elevation with fine trees, and intersected by narrow and remarkably fertile valleys. The most lofty mountain range is that which bears the name of the Yungling, or Sine-ling (i. e. Snowy Mountains). This range extends from north-east to south-west; and four other ranges, nearly parallel with each other, cross the country from east to west; of these, the Nan-ling is the most elevated, as well as the most extensive, and contains some snow-clad peaks. The mountain system of China extends to the borders of the Pacific, the Nan-ling range, or a branch from those mountains, reaching the borders of the ocean, near the volcanic island of Formosa, which may be regarded as the termination of our grand central axis.

We have now traced the central mountain band of the Old World, from its commencement on the shores of the Atlantic, to its termination on those of the Pacific. And, when we consider the effects of elevated land in arresting and condensing atmospheric moisture, and also in modifying the temperature of any region, we cannot but be sensible that this mighty ridge forms a very remarkable feature in the physical geography of this portion of the globe, imparting to it a great diversity of climate, adapting it for the habitation of an almost endless variety of animal and vegetable productions, and also giving rise to numerous vast and important rivers; thus, not only rendering the regions it traverses, remarkably varied and beautiful, but increasing their fertility, and their fitness for the abode and sustenance of immense numbers of the human species.

Before considering the northern branches which diverge from the mighty mountain knot of the Hindoo Koosh, it will be desirable to turn our attention to the natural features of the regions, situated to the south of the mountain ranges, which extend from that point to the Pacific.

. . . . . To Paquin of Sinean kings
And thence to Agra and Lahore of Great Mogul —MILTON.

China, being much diversified in its surface, possesses a corresponding diversity of climate and of vegetable productions. It is, however, so completely a cultivated country, that its actual indigenous plants can scarcely be determined. The mountainous districts are carefully planted with oaks, pines, and other forest trees; whilst the hills in some districts, are covered with camellias, or crowned with orange trees; and the bamboo forms forests in the valleys. In the latter localities, we also find the cocoa-nut, and other palms, the plantain, guava, litchi, sugar-cane: the peach, apricot, pomegranate, vine, fig, walnut, black mulberry, white mulberry (fig. 91), cotton (fig. 38), and tea-tree (fig. 29); whilst the sacred bean of India (fig. 3) occurs in the streams. The wax-tree affords materials for candles; and the lacker shrub produces a gum which forms the fine Japan varnish. The orange, of which there are several varieties, as well as the sugar-cane, both now so extensively diffused, are supposed to have been originally natives of this country. In the northern districts, wheat, millet, and sesamum (fig. 205), are grown; but the staple grain is rice (fig. 204), of which perhaps a larger quantity is consumed in China, than in any other country on the earth's surface. The curious and beautiful substance, erroneously called rice-paper, is obtained from the stem of a plant not altogether known to botanists, but supposed to belong to the Malvaceæ, or mallow tribe. It is naturally of the purest white, and consists of a portion of the stem cut into thin layers or sheets.*

The native wild quadrupeds of China are little known: its birds and insects are numerous and beautiful. Among the former, the pheasants are very conspicuous, including the superb pheasant (fig. 125), ring pheasant, golden or painted pheasant, and silver pheasant. The most remarkable insects are the silk-worm, the lantern fly, and the gigantic species of moth, called

* Our readers will remember, that in hot climates the mallow tribe are not, as with us, mere small shrubs or herbaceous plants, but appear in the form of forest treees.

the bombyx atlas, which measures full eight inches from the tip of one wing to that of the other.

Among the mineral productions of China, we meet with rubies, corundum, topaz, tourmaline, lapis-lazuli, &c. Gold is found, but not in large quantities; and silver occurs, both in its native state, and in combination with other minerals. Kaolin, or porcelain earth, of peculiarly excellent quality, is abundant, imparting to the porcelain of China the superiority for which it has long been celebrated. China is said to be as rich in excellent coal as any country in the world.

The climate of China is *excessive;* and this country forms an instance of the difference in the climate of regions situated on the eastern shore of the Old Continent, and regions in similar parellels, on its western shores. Thus, at Pekin, which is nearly a degree to the south of Naples, the cold is so great, that during the winter, the rivers are said to be frozen over for three or four months; whilst, in the summer months, the heat greatly exceeds that of Southern Italy.

The Indo-Chinese countries, including Tonkin, Cochin-China, Siam, the Birman Empire, Aracan, and the extended peninsula of Malaya, are intersected by various branches from the central line, taking a general direction from north to south, and giving a mountainous character to some portions of this territory. The Aracan, or Anapectu-mew Mountains, separate the Birman Empire from the British dominions.

The mountain districts of this region are covered with extensive forests of teak and other valuable trees, entangled with thick underwood, or jungle, the resort of vast numbers of wild animals. The southern and flat districts are particularly adapted for the cultivation of rice, which forms the staple food of the whole population. The finest sort of gamboge, or camboge, is procured from Siam, and is a gum resin, obtained, in the form of a yellow juice, from the bruised leaves and young branches of a tree, called *stalagmites.* Asam includes among its indigenous vegetable productions, the tallow tree (fig. 51), pepper plant (fig. 107), tea plant, cotton, sugar-cane, mango (fig. 77), jacca (fig. 97), bamboo, caoutchouc fig tree, sago palm (fig. 176), betel nut palm (fig. 180), &c.

Among the native animals, are the elephant of Siam (fig. 67), the one-horned rhinoceros (fig. 70), the royal tiger, leopard, &c. Neither jackals, hyænas, wolves, nor foxes, are known in this part of Asia; dogs are very numerous, and are used as an article of food. The oran-outang, the gibbous, or long-armed apes and other species, are met with in Malacca, besides various splendid birds, such as the gigantic argus pheasant, crown pheasant, great white cockatoo, and various brilliant coloured lories, parrots, and parrakeets.

The ruby, sapphire, and amethyst, are among the mineral productions of this region; and its metallic treasures are considered to be great; coal also appears to be plentiful, but is not used as fuel.

Hindostan, or the vast territory included between the Indus and the Ganges, although it is intersected by some branches from the great central line, does not possess any mountains at all approaching in elevation to the stupendous Himalayan range, which forms its northern border. The most lofty mountains are those which branch off from the Tibet Panjahl, and which, with that range, form a regular oval of snowy mountains, nearly encompassing the beautiful and fertile valley of Kashmere; and on the declivities of which, are many thousand acres covered with apple and pear trees, and vines, in full bearing, but without owners. The principal branches which intersect the peninsula of India, are the Vindhya range, (a continuation of the mountains of Guzerat,) the Eastern Ghàts, and the Western Ghàts. The Vindhya range crosses this territory from east to west, forming the northern boundary of the table-land which occupies the centre of the peninsula. This, as well as the Eastern Ghàts, which run parallel to the Coromandel coast, nowhere exceeds three thousand feet in height; but the Western Ghàts, which border the Malabar coast, and rise abruptly from the sea, are more elevated, especially in that portion of their course where they approach the Neilgerries, in which part, they are said to attain the height of eight thousand feet. These Ghàts form the western boundary of an elevated plateau, or table-land, of considerable

extent and altitude, some of the platforms having an elevation of five thousand feet above the sea, though the general level of the plateau of Dukhun, or Deccan, near the Western Ghàts, is about two thousand feet; and it gradually declines, occasionally by a succession of low steps, to the Coromandel coast. The natural productions of the latter district, assume all the characteristics of these of tropical regions; whilst those of the elevated table-land, approach nearer to the productions of temperate zones.

This elevated plateau affords an interesting geological phenomenon, in the occurrence of the most remarkable trap formation probably existing on the surface of the globe; there being evidence of a continuous formation of this description, covering an area of from 200,000 to 250,000 square miles, and this, without the intervention of any other rock whatever, whether at the level of the sea, or at the height of 4,500 feet. In treating of geology, we have remarked that the term *trap* was derived from *trappa*, (Swedish for a flight of steps,) because trap rocks occasionally assume that form:—the plateau of the Dukhun affords a grand specimen of this arrangement. The Konkun is a narrow strip of land, lying between the Western Ghàts and the sea, the mean elevation of which is less than a hundred feet above the sea; from this, the Dukhun abruptly rises by a succession of steps, or terraces, to the height of about 1800 feet; and the declination to the eastward, though less abrupt, is also by steps, or terraces: in that part, however, these occur at longer intervals; though in the neighbourhood of Munchur, five steps, or terraces, rising above each other, are so distinctly marked, that they have the appearance of being artificial. Stupendous escarpments, however, occur in some parts of the Ghàts; perpendicular walls being described as fully 1500 feet high, and others as almost double that height. "Fearful chasms, numerous waterfalls, dense forests, and perennial verdure," says Colonel Sykes, "complete the majesty and romantic interest of the vicinity of the Ghàts."

To the north and west of the Vindhya range, lies the

valley of the Indus, the soil of which is generally sandy, and covered with a saline efflorescence. The district of Sind, which extends on both sides of the River Indus, bears a striking resemblance to Egypt, as well in its natural features, as in its climate; both are bounded on one side by a ridge of mountains, and on the other by a desert; and both fertilized by the overflowing of their respective rivers, without which, they would be as completely desert as the adjoining regions. The Thurr, or Desert of India, is not, however, utterly destitute of vegetation; for, though in the hot months, all verdure totally disappears, the sand-hills after the monsoon are partially covered with grass and jungle shrubs, including an unusually numerous list of plants for a desert tract; "and the *whole of these*, in their berries, leaves, or fruit," says Sir Alexander Burnes, "though the spontaneous productions of the soil, are bountifully adapted to the food of man; a fact evincing the wise fitting of the means to the end, in a portion of the globe, where the most scanty crops are gleaned with difficulty from a dusty soil?"

To the north-east of the Vindhya range, the alluvial plains of the great valley of the Ganges extend, ascending very gradually from the sea in the Bay of Bengal, to the foot of the Himalayah Mountains. In approaching the base of this range, a close jungle is everywhere found, which, with more or less denseness, extends up these mountains to five thousand feet above the sea, at which elevation tropical shrubs disappear; and from thence to nine thousand feet, the arborescent vegetation is exclusively that of temperate regions; chesnuts, hornbeams, birches, hollys, and oaks. In the same region we meet with abundance of fruit trees, such as apricots, peaches, cherries, pears, apples, and walnuts: besides rich grapes currants, gooseberries, raspberries, strawberries, berberries, &c. The intervening valleys in the same region are, in some parts, absolutely covered with white and yellow jasmine, rose-trees, and gum cistus, and adorned with singularly beautiful groves of rhododendron, some bearing white, others delicate pink, and others splendid crimson blossoms, attaining the size of forest trees, even at the elevation of 10,000, or 12,000 feet above the

sea; beyond which, the rhododendron appears in the guise of a shrub, but disappears at 14,000 feet. The polyanthus grows at 11,000 feet, and has been noticed springing up as fast as the snow melts; buttercups and dandelions have been found at 12,600 feet; and a campanula has been seen in flower at the height of 16,800 feet. The corn grown on these heights, consists chiefly of wheat and barley. The limit of the successful cultivation of wheat, is about 10,000 feet above the sea; of barley, about 13,000 feet; rye and buck-wheat do not succeed beyond 11,500 feet. A fine green-sward, admirably adapted for pasture, still occurs, but this ceases at 14,600 feet above the sea; after which the mosses and lichens prevail. The Himalayah Mountains rise very suddenly from the low plains of India, but on the northern side they are flanked by the elevated table-land of Tibet. The different height of the snow-line on the northern and southern sides of this range, has been before mentioned, and likewise that this variation has been attributed to the radiation and also the reflection of the sun's rays, from the elevated plains of Tibet; the snow-line being thus raised to 16,000 feet on that side, whilst on the Indian side, it does not exceed 12,500 feet. The line of cultivation varies with the snow-line; and it is a remarkable fact, that precisely as the low plains of India are left behind, and the traveller enters the depths of the mountains, does he find this line more elevated. Thus, on the southern flanks of the Himalayah, cultivation nowhere extends above 6000 feet, but within the first passes, it rises to 7000, within the next, to 8000 feet, though in no part it exceeds from 9000 to 10,000 feet, until we arrive at the northern side, where it extends to 13,000 feet above the sea.

The forests of India are on an extensive scale, and include many plants known only as shrubs in our climate, but which there appear as timber trees; among such may be mentioned the rhododendron, "with blossoms red and bright," of which gun-stocks are made, the privet, and a bramble as thick as a stout man's arm. In these forests we likewise meet with many trees greatly resembling our own, or which are closely

allied to British species, and others which have almost become naturalized in Britain; thus, we find the walnut, ash, hornbeam, weeping willow, which in Nepal attains a magnificent size; and a species of oak, the trunk of which sometimes reaches the height of 80 or 100 feet before the branches spread. In the less elevated plains, however, the vegetation assumes a different character, and a vast number of plants occur, peculiar to warm latitudes, and incapable of thriving in temperate climates. Among these, are the teak (fig. 133), the sandal wood (fig. 115), the tree fern of Nepal, 45 feet in height; the rapidly growing bamboo (fig. 210), whose stems or culms clothed at the top with copious dark green foliage, frequently exceed 100 feet in height, and which literally constitute forests. The celebrated banyan of India, also, usually called the peepul tree (fig. 93),

> Branching so broad and long, that in the ground
> The bended twigs take root, and daughters grow
> About the mother tree.

These trees are constantly planted near the Hindoo temples. A banyan tree growing on the banks of the Nerbuddah, is described as covering an immense area, the circumference of the space occupied by the parent tree, and its numerous "daughters," exceeding 2000 feet; 320 large trunks have been counted, and the smaller ones exceed 3000, whilst each of these is continually sending forth branches and pendent roots, to form other trunks. It is said that 7000 men have obtained shelter under this very remarkable tree, or group of trees.

But among the grandest features of Indian scenery, the palm trees stand pre-eminent, including the superb palmyra, or flabelliform palm, the fan palm (fig. 174), thorn-leaved palm (fig. 182), the date palm, and the cocoa-nut palm, which latter the Hindoos profess to apply to 365 different uses.

Whilst the high table-lands of India include the trees of temperate zones, and the carrot, turnip, and radish, rank among their indigenous productions, in the low districts we meet with the boswellia, which produces gum olibanum; with ginger, nutmeg, and spikenard; sugar-cane, cotton, and indigo (fig. 64),

the cashew nut, and the elastic gum vine (*Urceola elastica*), which, as well as some species of fig, affords caoutchouc. The fruit trees also are very numerous, comprising the orange, lemon, lime, shaddock, pomegranate, pine-apple, tamarind, musk melon, water melon, guava, fig, mulberry, rose apple, mangosteen (fig. 28), and mango, the latter valuable tree being in fruit, and rarely failing of producing abundant crops in the hot dry season, (occurring in the months of May and June,) at which period, other vegetables are usually parched up; besides, the yet more important plantain (*Musa paradisaica*), whose graceful form is represented in the accompanying cut.

The flowering plants of India are no less varied than its fruits, and are distinguished for their splendour and beauty. Nothing can exceed the richness of the vegetation during the monsoon. The lakes, and other waters of this region, also abound in many highly curious aquatic plants. Water lilies of various hues are very numerous; and among these, the most remarkable is the *Cyamus nelumbo*, or sacred bean of India, whose splendid flowers, of a full rose colour, are embosomed in leaves of the tenderest green.

Among the animals which more particularly characterize Continental India, may be mentioned the solemn ape, the common Indian monkey, the Asiatic lion, the royal tiger (fig. 13), leopard, panther, cheetah, or hunting leopard (fig. 17), hyæna, wild cat, Indian ichneumon, porcupine, hare, pangolin or manis (fig. 62), called by the natives "the tiled cat," from the scales being arranged like tiles on the roof of a house; the elephant, rhinoceros, wild hog, nylghau (fig. 94), four-horned antelope, sheep, goat, Brahmany bull, with its remarkable hump, which curious appendage, however, this noble animal loses, if employed as a beast of burden. We have seen, whilst considering the northern regions of Europe, that the cow and sheep diminish in size in those high latitudes: a similar effect appears to be produced on some others, by removal into hot climates, uncongenial to their nature: thus in Central India, the ass, which is unknown in a wild state in this region, but has been tried in



Plantain.—Musa Paradisiaca.

a domesticated state, does not exceed a Newfoundland dog in size.

The birds of India are very numerous, and many of them distinguished by the most splendid plumage: an instance of which is afforded by the well known peacock. The greater number of Indian birds are, however, deficient in song; though a few species have sweet notes, and the lark of India has the same habits, and the same lively and delightful song, as the skylark of our own plains.

Teach us, sprite or bird,
What sweet thoughts are thine:
What objects are the fountains
Of thy happy strain!
What fields or waves, or mountains?
What shapes of sky or plain?

The cuckoo is the identical bird of Europe; and his familiar note may be heard in all the highlands of Central Asia. The common sparrow, and the snipe, are also those of Europe. The original of the domestic fowl is most abundant in the woods of the Ghàts. Among birds more characteristic of this region, may be mentioned the weaver bird, remarkable for its pendent nest, woven in the most curious and ingenious manner, with fibres of grass; the tailor bird, whose equally curious nest is formed of leaves, most skilfully sewed together; and the gigantic crane, or adjutant (fig. 129).

Reptiles are very numerous, including many genera of saurians, among which are crocodiles, garials or gavials (fig. 141), and monitors: and also a great variety of serpents, from the python to the small and beautiful carpet-snake. Some of these species are venomous, especially the deadly Cobra da capello; but the greater number are innoxious.

A remarkable species of land crustacea, called the kenkra, pervades the valleys and table-lands of the Ghàts, burrowing in the earth during the cold season; but during the monsoon, covering the ground in such numbers that travellers ride and drive over them, or trample upon them in the high roads.

India teems with insects, among which we find the coccus

laccus, or lac insect; the silk-worm; the destructive white ant, which, however, performs the useful office of nature's scavenger in hot climates; the scorpion, in great numbers; and a very numerous assemblage of splendid butterflies, moths, dragon flies, &c.

The metalliferous minerals are met with only in small quantities in Hindostan, for though gold and silver are found in some parts, they are by no means abundant; iron, however, is extensively diffused. Large deposits of coal occur in some districts, and these appear to belong to the same geological era as the coal formation of Britain. Among precious gems we meet with the diamond, which is found in alluvial soil, and in the beds of some rivers; the ruby, topaz, chrysolite, precious garnet, amethyst, cat's eye, &c. Carnelian, jasper, and agate, are also very abundant in India.

The islands of Asia, from their position, and the general nature of their productions, have so much affinity with the regions we have now been considering, that it will be desirable to direct our attention to those groups, ere proceeding to consider the northern regions of Asia.

These islands are numerous, and present some remarkable features in physical geography; among which, perhaps, the most striking is the volcanic band, traceable, in a linear direction, through a considerable number of these islands, and to which we shall again have occasion to refer. The other natural features of these islands also present much that is interesting, their productions being rich and varied.

Commencing with Japan, we find the aspect of this region bold and striking: rugged mountains, among which rise its numerous active volcanoes, traverse the interior from north to south; but an ample space is covered with the richest valleys and plains. To these islands our gardens are indebted for many highly-prized plants, among which are the hydrangea, pyrus japonica, and aucuba. One of the most remarkable plants of Japan is, however, the Cycas revoluta, which is interesting to the geologist, from the resemblance it bears to certain fossil

trees belonging to the later systems of the Secondary Period. But perhaps the circumstance of greatest interest attached to the vegetation of the Japanese islands, is the occurrence of some North American plants, of which about thirty species have been observed; these islands thus presenting a union of the vegetation of the Old and the New World. Japan includes among its birds, a splendid peacock, distinct from the Indian species; and two remarkable domestic fowls, singularly differing from each other; the one the crisped cock, having the whole of the feathers curled up so as to appear almost like wool, and the other the silk cock, having the webs of the feathers so entirely disunited, that the bird appears covered with silky hairs; both species are usually white.

Among its mineral deposits, Japan includes gold, silver, cinnabar (the ore of mercury), copper, iron, and coal of excellent quality.

The islands included under the general name of the Indian Archipelago, are mostly of varied surface, many of them being traversed by lofty mountains, and containing active volcanoes. Situated almost immediately under the equator, these islands are exposed to the intensest rays of the sun, but surrounded as they are by the waters of the ocean, and varied by lofty mountains in their interior, they enjoy abundance of moisture, and afford an admirable instance of the luxuriant vegetation displayed in equatorial regions, possessing an insular climate. Not only do they yield in abundance all the ordinary products of tropical countries, but contain various highly valuable spices and fruits, peculiar to their own soil, some of which cannot be cultivated with advantage in any other region. These are, however, mostly confined to the south-eastern islands.

Nor are these islands less celebrated for their mineral treasures: for though iron and copper are not so abundant as in some other regions of the globe, the island of Banca is rich in that rare metal, tin; and gold is found in considerable quantities in Sumatra, Celebes, Luzon, and Borneo, especially in the latter island, where it is accompanied by the diamond, those found in this island being distinguished as Landak diamonds. One of

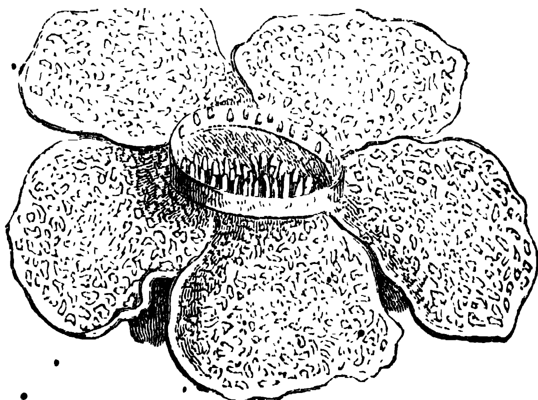
the largest diamonds that has been discovered, is in the possession of one of the princes of Matan in Borneo. It weighs, in its present rough state, 367 carats, but by the process of cutting it would be reduced to one half. Its value, according to the estimate of diamond dealers, is 269,378*l*.

Forests of extraordinary luxuriance cover a great part of these islands, generally clothing the mountains to their very summits, and including among their number, a great variety of ornamental woods, and plants producing odoriferous gums. Bamboos and canes (fig. 177) overspread a vast surface of country, serving for building, cordage, and other important purposes. Indigo, and the sugar-cane, are indigenous, the latter being eaten by the natives as an esculent vegetable. The yam is also a native, but not much prized. Maize is grown; but rice may be considered as the staple food of a large portion of the inhabitants. Among the numerous fruits of these islands, are the guava, mango, mangosteen, and durion, the two latter being considered the most delicate fruits produced in any part of the globe, though the durion is said to possess a very forbidding scent. The spice plants, however, form the most peculiar feature in the native productions of these islands. Among these, the clove (fig. 16), a native of the Moluccas, stands foremost, as one of the most precious products of the East. The clove of commerce consists of the unexpanded flower, the corolla constituting the rounded head, and the calix the tapering portion. The nutmeg tree (fig. 4) is chiefly confined to the group called the Islands of Banda, and in its native soil, it is almost always loaded both with blossoms and fruit. The fruit of the nutmeg tree is red and pulpy; and it is well known that the spice called mace, forms a layer between the outer pulpy coat and the nut, or seed. Mace when fresh, is of a beautiful crimson colour. Pepper is another produce of these islands, growing in spikes on a climbing plant. Here we also meet with the camphor tree (fig. 39), cardamoms, ginger, the caoutchouc tree (fig. 99), &c. &c. In the extensive and beautiful island of Ceylon, we meet with the cinnamon tree (fig. 117), which is a species of laurus, and grows to the height of twenty

or thirty feet; the flowers, fruit, and bark, all appearing to partake of the peculiar fragrance of the tree. In this region, also,

> Rich with fruits, the tree of Paradise,
> The plantain, spreads its large and slender leaves,
> And there the pictured palm is seen to rise.

The latter plants are very abundant in these islands, among which are the palmyra palm (fig. 178), the fan palm, cocoa-nut, and sago palm. The pith of the latter, when dried, forms a farinaceous powder, of which a single tree will produce 600 or 800 lbs. It constitutes the staple food of some of the islands. The broad-leaved cycas (fig. 140) also grows in this region, whilst the mangrove (fig. 13) occupies the swamps of New Guinea and the adjacent islands, and the deadly upas (fig. 99) spreads its poisonous influence in Sumatra. Perhaps, however, the most remarkable productions of this region, are the singular and gigantic parasitical plants, the Brugmannia zippelii, the Rafflesia arnoldi and Rafflesia patma. The Rafflesia arnoldi is a native of Sumatra, and is a plant without stem or leaves, and



R[illegible] a Ar[illegible]

with roots so minute, that they are embedded in the slender stem of a species of vine, which forms its station, yet bearing a flower of the most enormous dimensions, its diameter being three feet six inches, and its weight fifteen pounds. The colour is brick red, inclining to orange, and it emits a powerful, and highly offensive odour, resembling tainted beef. A second species, the Rafflesia patma (fig. 212), measuring two feet across, has been found on the small island of Nava Kambangan.

In their native animals, these islands also display the splendour and variety which we have before remarked characterize intertropical regions. They abound with large and ferocious quadrupeds, and also with crocodiles and other reptiles. The monkey tribes are very numerous, including the oran outang (fig. 1), and the singular proboscis monkey, a native of Borneo, and which is distinguished from all other species, by a long and projecting nose. Bats are also very numerous in species, and among these are the roussette bats (fig. 8), commonly called vampires, which chiefly inhabit Timor. Tigers are very abundant in Sumatra, where several different species are said to occur. Elephants also abound in that island, and two species of rhinoceros have been observed. In Sumatra also is found that singular animal the Malayan tapir (fig. 72), whilst Amboyna forms the habitation of the babyroussa hog (fig 76)*. The cats of Sumatra appear to differ from all other modern species, there being one with a knobbed or twisted tail; and another wholly without a tail. The dogs hunt in packs, and resemble the *dingo*, or Australian dog. Among the reptiles of these islands, besides large and formidable crocodiles, we find a numerous list of snakes, including the gigantic python.

The birds of the Indian Archipelago are of surpassing splendour, comprising among their number the magnificent family of the birds of Paradise (fig. 119), which principally inhabit New Guinea and the adjacent islands. The cassowary (fig. 127) is also a native of New Guinea, as well as the beau-

* The two latter animals form the modern representatives of some of the extinct pachydermatous animals of the Eocene era of Geology.

tiful tiger bittern. The gay plumed lories and parrots are exceedingly abundant, especially in the Moluccas; whilst the forests of Sumatra are adorned by the splendid Argus pheasant, and doves of beautiful colours; and those of Java by a variety of peacock, and the green-fruit-eater, which so closely assimilates in colour with the foliage of the trees it frequents, that it is undistinguishable, even by a near observer. The curious edible birds' nests, which are formed by a species of swallow, are found near the sea-shore, in these islands and on the adjacent coasts. The insects are exceedingly splendid, exhibiting the most singular forms, and the most surpassing brilliancy of colour. Among the latter, is the Amphrisius priamus, one of the most beautiful known insects; and among the former, is the Mantis siccifolia, whose form rather resembles a leaf than an insect. Both of these are found in Amboyna.

The coasts of Celebes, Amboyna, and the Eastern Islands generally, abound in tortoises, the great supply of tortoise-shell being obtained from thence.

The Maldiva Islands, situated to the westward of the peninsula of India, consist of a vast range of coral isles and reefs, extending for nearly five hundred miles, supposed to include 30,000 or 40,000 islets, all presenting a similar appearance, that of a tuft of trees on the water: the greater number being covered with cocoa-nut palms, and the highest land in the whole group, not exceeding twenty feet above the sea. The only mammiferous animal inhabiting these islands, is the flying cat (fig. 9).

CHAPTER XVI.

NORTHERN ASIA.—KUENLUN MOUNTAINS.—ALTAI MOUNTAINS.—URALIANS.—TIBET.—SIBERIA.

> Beyond, a frozen continent
> Lies dark and wild, beat with perpetual storms
> Of whirlwinds and dire hail. MILTON.

HAVING completed our brief sketch of the leading features presented by the rich and varied regions of Southern Asia, we will now turn our attention to the northern districts of that division of the globe.

Extensive mountain ranges diverge northwards from the Hindoo Koosh, the greater part of which run nearly parallel with the grand central line, though at varying distances. The most southerly of these ranges, the Kuenlun, forms the northern boundary of the elevated table-land of Tibet, into which it sends various collateral branches of considerable altitude. The rugged and lofty Belor range, which also diverges from the Hindoo Koosh, takes, in its commencement, a northerly course, but in its prolongation in the Mooz-Tagh, or Thian-Chan, extends to the eastward, enclosing the sandy desert of Cobi, or Gobi, until it unites with the mountains of China, to which the elevated Kuenlun also extends. From the same mighty central group of the Hindoo Koosh, branches off the vast system of the Altai Mountains, which separate Tartary from Siberia, and which, under the several names of the Sayanskoi, Yablony (or apple), and Aldan Mountains, extend to the shores of the Pacific, near Behring's Straits. These mountains are not generally of very great elevation, though the highest summit, Bieluka, attains the altitude of 11,000 feet above the sea level. A branch from this system extends through the peninsula of Kamtchatka, giving a mountainous character to that territory, which is remarkable for the numerous *sopki*, or volcanos, whose elevated snow-clad

summits rise far above the general level of the mountain range.

The Oural, or Uralian mountain range, which forms the separation between Siberia and European Russia, may perhaps be rather considered as a distinct system, than as a branch from the central line, though, in its southern termination, it approaches very near the western extremity of the Altai system. The Uralian Mountains are by no means elevated in their southern portion, but increase in altitude in their northern extension, several peaks rising to the height of 8000 or 9000 feet; though these are not situated in the principal range, but appear like detached peaks. The Uralian Mountains are celebrated for their mineral treasures, which have lately risen into great importance. About six years since, extensive beds of sand, containing small particles of gold, were discovered on the Siberian side of this range, as also, though less abundantly, on its European declivities; and in the year 1836, about 19,000 marks of gold were obtained from this source. This gold is always found united with a small portion of silver. On the western, or European side, the sand in some parts contains a considerable proportion of platina, and six platina mines occur; that metal being usually combined with a small quantity of gold. It is a remarkable circumstance, that in beds of sand containing gold, or platina, diamonds are frequently found. Baron de Humboldt directed the attention of the Russians to this singular fact, and not long afterwards, some of these precious gems were discovered in these beds of auriferous sand, though it appears that the diamonds hitherto found have only been of small size. Iron and other metals also abound in these districts; and Mount Blagodat, situated on the Siberian side of the Uralian range, and which is 1534 feet above the sea. is entirely composed of magnetic iron ore.

The elevated table-land of Tibet, or Tubet, is bounded on the south by the lofty Himalayah Mountains, and on the north, by the perhaps little less elevated Kuenlun range. This plateau may be considered as the most elevated plain on the surface of the globe, its average height appearing to be

more than 10,000 feet above the level of the sea. Its great elevation, in the latitude in which it is situated, might lead us to suppose that it would be destitute of useful vegetation, yet we find that it not only yields excellent pasturage, but in some favourable situations, corn, and even the vine, arrive at great perfection. The peculiarity of climate which renders this vast surface habitable for man, is attributed to the radiating power of the plains themselves, which, as has been before observed, has also the effect of raising the snow line on this side of the Himalayah Mountains. The circumstance of these plains being screened on the north by the Kuenlun range, may also tend to moderate their temperature.

Among the native vegetable productions of Tibet, are apricots, walnut and apple trees, gooseberries and raspberries, the hazel, rhododendron, willow, oak, deodar pine, oriental fir (fig. 149), juniper, &c.

The animals inhabiting the vast plains of Tibet, are numerous and important. The yak, or grunting ox (fig. 99), is an animal of great utility, both as a beast of burden, and for the rich and nutritious milk it affords. The tail of this animal, consists of a mass of long flowing glossy black hair; and, under the name of *chowrie* it is in general demand among the chiefs of India, both as an ornament, and as a flap for dispersing insects. Another highly valuable animal, is the Tibet goat (fig. 101), which yields the fine wool used in manufacturing the celebrated shawls of Kashmere. The wool grows close to the body, and is covered with a profusion of thick hair. This animal is rather smaller than the English sheep, and is the most elegant of the goat kind. The sheep of Tibet are also particularly fine; and both these and the goats, are used as beasts of burden, in crossing the lofty and steep passes of the Himalayah Mountains. The musk deer (fig. 84), from which the perfume of that name is obtained, is very abundant in Tibet.

To the north of the Kuenlun range, lies the desert of Cobi, or Gobi, which presents strong indications of having been at some former era, within the recent period, submerged beneath

the waters of the ocean, though it is from 3000 to 4000 feet above the level of the sea, and now forms part of the plains of Mongolia. This district appears to be rich in the finer metals and gems. In one spot, the quantity of gold is so great, that at the period of Mr. Moorcroft's visit to this region, from five hundred to a thousand men were constantly employed in collecting it, on the part of the Emperor of China. Numerous rich deposits are also supposed to exist in Khoten; but, if discovered, they are carefully concealed, lest the owners should be compelled to work them for the emperor's benefit; and thus, by a mistaken policy, these treasures, instead of proving of advantage to the inhabitants, are b[illegible] buried in the earth. A valuable mine of rubies exists at A[illegible]oo, but it is left unworked; and not long since, a rich vein of silver was accidentally found near Eela, and information of this discovery given to the umban, or resident governor. [illegible]er, having extracted a certain quantity for his own use, caused it to be closed up, forbidding its being further explored. His secret treasure, however, did not escape detection, and he was shortly afterwards poisoned.

Some of the animals of this region are remarkable and interesting. The camel, according to Mr. Moorcroft, is here found wild, and is pursued by hunters as game. Tigers are said to inhabit the mountains of Khoten, which includes among its native quadrupeds, the leopard, wolf, fox, hare, yellow, or light-brown bear (fig. 29), &c. Here also we meet with the onager, or wild ass of the desert (fig. 78); though perhaps the most remarkable animal of these regions, is the Mongolian horse, which inhabits in troops the vast deserts of Central Asia. This animal is light and elegant in its form, and almost inconceivably swift in its motions; its air is wild and fiery, carrying its head erect, and snuffing up the wind. The tail much resembles that of a cow, having hairs only at the end. It is said that, at the present day, all attempts at taming this singular animal have proved unsuccessful, though it appears to have been domesticated in ancient Greece.

The vegetation of the less elevated portion of this region

much resembles that of Southern Europe, the vines being very productive, and wheat, barley, and maize, being cultivated; there are, however, few trees of value for timber; scarcely any being met with, except mulberry trees, and some poplars and willows.

The Beloor range of mountains separates the table-lands of Tibet and Mongolia from the plains of Turkistan, which, including Bokhara and Kokaun, stretch from thence to the Caspian Sea, gradually declining in elevation as they approach its shores, and those of the lakes of Zaizang and Aral; forming a series of terraces, terminating in the saline steppes in the neighbourhood of the latter lake, which are below the level of the ocean. A large portion of this territory consists of a desert tract, composed partly of a hard clay, and partly of plains and hillocks of sand, in some places, however, overgrown with brushwood, and covered with scanty herbage. The greater part of this district is arid; but the flat country bordering on the River Volga, is very swampy. The portion of this region which is watered by the River Oxus, has a much more varied surface, and accordingly, differs greatly in character from the unprofitable territories just described; not only being fertile and productive, but celebrated for its romantic glens, choice fruits, and abundance of nightingales.

Gold is found in considerable quantities on the banks of the Oxus; and, in the same district, lapis lazuli, and very fine rubies, occur.

The Caspian Sea abounds in water-fowl and fish; among the latter is the sturgeon (fig. 155). The most esteemed caviare is formed of the roe of the sterlet, a smaller species of sturgeon, also inhabiting this inland sea.

Nearly the whole of Northern Asia is occupied by the vast Lowland of Siberia, which commences at the foot of the Uralian Mountains, and extends almost to the shores of the Pacific. This extensive plain, skirted on the south and east by the Altai Mountains, and their eastern prolongation, and exposed without any sheltering highland, to the cold northern blasts,

experiences a very severe climate, and presents one immense and dreary level, not more than one-third of which is supposed to be capable of cultivation. Throughout nearly the whole of the northern tracts, the earth is bound in perpetual frost; and even the broad level belt which stretches across the southern parts, consists of little else than marshy and salt steppes, yielding only saline plants, unfit for the sustenance of man. Some of the southern districts bordering on the rivers, are, however, covered with luxuriant pastures, and, when cultivated, yield unusually abundant crops.

Siberia has been celebrated, from a remote period, for its mineral treasures*. The whole country appears to teem with metals of various kinds. The principal gold mines are those of Catherinenberg, at the base of the Uralian Mountains. The occurrence of auriferous, or gold-bearing sand, of platina, and of copper, on the western side of that range, has already been noticed. The Altai range is at least equally famed for its metallic treasures, especially for its silver; the mines of that metal being in some parts so numerous, that "the whole district may be said to be silver;" whilst in others, on the removal of the slate covering, an almost unbroken mass is found, of ores of gold, silver, and copper. The stores of iron also seem inexhaustible. Coal is said to be worked in Siberia; and rock-salt is abundant. Among the precious stones of this region, are the diamond, emerald, topaz, chrysolite, beryl, onyx, and garnet. Lapis lazuli and malichite also occur; and a remarkable and useful product is afforded by the mines of talc, which mineral is used as a substitute for glass, in the whole of Asiatic, and in part of European, Russia.

The vegetation of Siberia bears a general resemblance to that of Northern Europe; though the scarcity of *hard wood*

* Ancient mines have been discovered in the neighbourhood of Krasnojask, on the River Yenesei, which have been wrought at some former period of which there is no account, or tradition. The instruments used in the mining operations have been found, and these are of forms and materials indicating great antiquity; including huge hammers made of stone, and instruments resembling pickaxes and wedges, made of copper. The props which supported the earth are said to be petrified.

trees, such as the oak, beech, &c., forms a striking feature in this region. The birch may be considered as the preponderating tree of this class; and of this we meet with several species. Willows are likewise very numerous; both in some of the steppes, and occurring among the plants approaching the last limits of vegetable life, in the cold and more elevated districts. Siberia also numbers among its trees, the Siberian crab (fig. 59), the poplar (fig. 112), which is found on the banks of the rivers; and the aspen (fig. 113). On the declivities of the Altai Mountains, grow the Siberian pine (fig. 142), Siberian silver fir (fig. 148), Siberian cedar (fig. 154), larch (fig. 156), and juniper (fig. 162).

The peninsula of Kamtchatka might, from the parallel of latitude in which it is situated, be expected to possess a climate similar to that of Great Britain; but, placed on the eastern side of the continent, and deprived of the various conditions which temper the climate of our favoured island, and also of Western Europe generally, and being at the same time traversed from north to south by a range of snow-clad mountains, it possesses an arctic climate, scarcely enjoying three months exemption from frost; and all attempts to raise the hardiest species of grain, have proved unsuccessful. Berries of various kinds, however, and some roots, afford a supply of vegetable aliment.

The deficiency of vegetable food in Kamtchatka, and in Northern Asia generally, is, however, in some degree compensated by the abundant provision of animal food, afforded by the vast numbers of land animals, as well as marine mammalia, and the countless flocks of grouse, woodcocks, wild geese, and ducks, which frequent this region. The valuable rein-deer is found in every part of Siberia, but more especially on the bleak shores of the Northern Ocean. The elk is also an inhabitant of this region; where we likewise meet with the arctic fox (fig. 25), and polar bear (fig. 27). The most characteristic feature in the zoology of this region, is, however, the abundance of the smaller fur-bearing animals, such as the ermine (fig. 35), sable (fig. 36), &c.: these territories, which,



White Birch.—Betula Alba.

from their chilly climate, are incapable of nourishing most of the valuable productions of more genial climates, being thus amply stocked with suitable inhabitants, protected from severe cold, either by the richest and softest, as well as most beautiful furs, or by an internal defence of fat, or some other unctuous substance. The skin of the ermine, found on the banks of the rivers Witim and Olekma, is esteemed the finest in the world. That curious little animal, the economic mouse, is an inhabitant of Siberia. Endowed with the most extraordinary instinct, this little creature burrows in soft turfy ground, in which it deposits its stores in summer, thus providing an ample supply for its wants, during the long and rigorous winter of its native country. Among the domesticated animals, the Siberian dog holds an important place; being much employed both in Kamtchatka, and in various parts of Siberia, for drawing sledges over the dreary and snow-covered surface.

CHAPTER XVII.

VOLCANIC REGION FROM THE ALEUTIAN ISLANDS TO THE MOLUCCAS.—VOLCANIC LINE FROM FORMOSA TO THE CASPIAN.—VOLCANIC REGION FROM THE CASPIAN TO THE AZORES.—ICELANDIC VOLCANIC REGION.

Where the slumbering earthquake
  Lies pillowed on fire;
And the lakes of bitumen
  Rise boilingly higher.—BYRON.

HAVING now come to a termination of our rapid travels over the surface of the vast territories of Europe and Asia, let us, ere directing our attention to Africa consider some of the most striking evidences of the present energy of subterranean heat, in the regions we have been considering; confining ourselves (with very few exceptions) to notices of volcanic eruptions, and convulsions of the earth, recorded as having occurred within the last hundred years.

The portion of the globe we have already traversed, besides other indications of volcanic action includes two of the marked volcanic bands; that from the Aleutian isles to the Moluccas; and that from the Caspian to the Azores; and also, the Icelandic volcanic region.

The volcanic region from the Aleutian Isles to the Moluccas, claims our first attention. This may be considered as connected with the volcanos in the peninsula of Alyaska, to which we shall have occasion to recur, when our attention is directed to the American volcanic region. In our present line, the volcanic band extends at first in a westerly direction, for about two hundred geographical miles*; it is then prolonged southwards without interruption, through a space of sixty or seventy degrees of latitude, to the Moluccas, where it branches off in different directions.

In the Aleutian Archipelago, almost every island appears to be volcanic, and earthquakes of the most terrific description, continually agitate and alter the surface of the land, and the bed of the ocean. A new island, four miles in circumference, and the summit of which is said to be 3000 feet in height, rose *at once* from the sea, in the year 1806. Another new island of considerable size having a peak of equal elevation was formed in 1814.

The volcanic line is continued in the peninsula of Kamtchatka, which is subject to severe earthquakes, and which contains no less than thirteen volcanic peaks. Seven of these volcanos, or sopki, are in a state of activity; and they are mostly of great elevation, their isolated and conical forms towering proudly above the rugged mountain range which traverses the peninsula. The peak of Klutchefskaia is 15,825 feet above the sea.

The Kurile Islands constitute the next continuation of the volcanic band, there being a train of volcanic mountains in these islands, nine of which are known to have been recently in a state of activity. Earthquakes have also at various periods convulsed and altered the whole area.

* Nearly 230 British statute miles.

From hence the volcanic line is prolonged in the Japanese group. The island of Yesso, or Jesso, contains some active volcanos; and in Nipon or Nifon, the number is very considerable, Slight earthquakes also are most incessant, and violent convulsions are experienced at distant intervals. Such was the tremendous earthquake which occurred in August, 1783, and which was accompanied by a volcanic eruption.

Between the Japanese and Philippine Islands the volcanic chain is continued, and displayed in several small insular volcanic vents. Sulphur island in the Loo Choo Archipelago, contains a sulphuric volcano, which emits white smoke, accompanied with a strong smell of sulphur. The island of Formosa is volcanic, and suffers greatly from earthquakes; and there is an active volcano in the Bashee Islands, which was in eruption in January, 1838.

Luzon, the largest of the Phillippines, contains three active volcanos; and a severe earthquake occurred at Manilla in 1833. A volcano in the island of Mindanao was in violent eruption in 1764.

The volcanic band is next prolonged through Sanguir and the north-eastern extremity of Celebes, to the Moluccas, by

> . . . . The isles
> Of Ternate and Tidore, whence merchants bring
> Their spicy drugs

A violent eruption took place in the great volcano of Ternate in March, 1839, the consequence of which has been the almost entire desolation of this once fertile island. A similar fate, though of less recent occurrence, befel the small island of Sorea, one of the Moluccas, which, though formerly habitable, now consists of one great volcano.

The volcanic region at this point becomes more widely extended, being continued in one direction through Celebes and Borneo; and in another, through Banda, New Guinea and New Britain, to various parts of the Polynesian Archipelago. The *linear* volcanic band, however, whose course we have followed from the Aleutian Isles, may be regarded as more especially prolonged in a third direction, which consists of a chain of ele-

vated volcanos passing through the islands of Sumbawa, Java, and Sumatra, to Barren Island, one of the Andaman group, in the Bay of Bengal, where it terminates.

One of the most violent eruptions on record in history, occurred in April, 1815, in the volcano of Tomboro, in the island of Sumbawa. A violent whirlwind preceded the eruption, carrying up houses, trees, cattle, and even men, into the air, and sweeping everything before it. Great tracts of land were covered with lava, and the fall of ashes and volcanic dust was so prodigious, that at Java, three hundred miles distant, the obscurity in the day time is said to have been most profound, so that nothing equal to it was ever witnessed in the darkest night. The earthquakes accompanying this eruption, extend one thousand miles in every direction, and the explosions are said to have been distinctly heard in Sumatra, at the distance of one thousand miles in a direct line. The floating ashes and scoriæ, for some days formed a mass two feet in thickness, on the surface of the ocean, which greatly impeded the navigation among those islands. A subsidence of eighteen feet took place on the western coast of the island; and thus the sea remained permanently at the depth of eighteen feet, on places previously occupied by dry land. Out of a population of twelve thousand, only twenty-six survived on the island.

Java contains thirty-eight large volcanic mountains, many of which continually emit smoke and sulphureous vapours; and tremendous eruptions and violent earthquakes have at various periods occurred in this island. One of the most remarkable was the eruption of Papandayang, in 1772. This volcano previous to that period, had an elevation of 9000 feet; but during this eruption the ground gave way, and a considerable part of the volcano disappeared, the height of the cone being reduced to about 5000 feet. An area of ground, fifteen miles long and full six in breadth, was thus wholly swallowed up in the bowels of the earth. The volcano of Ganteer near Batavia, burst forth in fearful eruption on the 22nd of May, 1840. The result of this eruption, which lasted for several successive days, has been a vast enlargement of the crater, whilst the mountain, which

was previously clothed half way up its sides with vegetation, has been converted into one mass of arid and blackened rock and scoriæ.

It has been made a subject of question by Baron de Humboldt, whether a volcanic band, though in a lesser degree of activity, but which may be considered as forming a continuous line with the volcanic region, extending from the Caspian to the Azores, may not exist in the line of the mighty mountain range which we have been tracing across the centre of Asia. A large portion of this part of Asia is still unknown to European travellers; but the observations of those who have recently visited some of those territories, tend to confirm this opinion. When compared with the energetic volcanic band, whose course we have been following, we shall perhaps find little in this region to engage our attention: indications of active subterranean heat are not, however, wanting, and the fact of its occurrence *in the line* of this mighty mountain range, at once attaches a high degree of interest to its consideration. This volcanic band is regarded as commencing with the volcanic island of Formosa, where, as already mentioned, earthquakes are frequent. It next enters the Chinese territory.

No active volcanos are known to exist in China Proper, but a vast volcanic district occurs in Mongolia, (said to occupy a surface of 7000 square miles,) which contains several extinct volcanos, and some in a state of activity. The most remarkable volcanos of this region, appear to be situated in the line of the Mooz-tag, or Thian Chan Mountains, which seemingly connect the mountains of China with the Hindoo Koosh. The most conspicuous among these volcanic mountains, are Pechan and Hotcheou*.

But, although China may not contain any active volcanos, that country is, and has for ages been, subject to violent earthquakes. One of the most severe on record, occurred in the fourteenth century, commencing in 1333, and lasting for ten

* Volcanic vents are usually met with comparatively near the sea, and the occurrence of these volcanos, at the distance of from 900 to 1200 miles from the sea, may be noticed as a remarkable circumstance.

years; this terrible convulsion being attended with a vast destruction of life and property, and with many changes in the surface of the country. This severe disturbance of the earth's crust has been supposed to have extended westwards in the line we are now attempting to trace *. Accounts of the intermediate regions have not been handed down to us; but Asia Minor and Egypt were violently convulsed in 1346, and in the following year earthquakes were experienced in Cyprus, Greece, and Italy, as well as over a great part of Europe, thirty villages being said to have been totally destroyed in Carinthia; and these agitations of the earth continued to recur at intervals in Germany, France, Silesia, Poland, England, and other parts of Europe, until the year 1360. China is, to the present day, subject to these visitations; an earthquake of considerable severity having occurred on the 24th of June, 1830, at Tayming, situated to the north of Houan.

Gaseous exhalations also are common in China; and there are some of these natural vents in that country, which have been burning for centuries, and which are turned to economical account. Thus, in the neighbourhood of Tchelicout-cheou, the salt works were formerly heated and lighted by means of these fountains of fire; bamboo pipes being employed to conduct the gas from the spring to the place where it was intended to be consumed. These bamboo pipes are terminated by short tubes of pipe-clay, to prevent their taking fire. A single well is sufficient to heat more than three hundred kettles. The fire thus obtained is said to be so exceedingly brisk, that the caldrons are rendered useless in a few months. Other bamboos conduct the gas, which is used for lighting the streets, and the apartments, or kitchens. Thus, nature presents in this place a complete establishment of gas-light; and it appears, that we must yield to the Chinese, the palm of having been the first to apply gas to the economical purpose of lighting up houses and streets.

The line of mountains which connects China with the Himalayah range, is too little known for any certain conclu-

* See *Treatise on Physical Geography*, by Professor TRAILL.

sions to be arrived at respecting its nature; and the Himalayah range itself appears to present but little indication of volcanic agency, though hot springs occur, some being of very high temperature; and earthquakes appear to have rent and shattered some of these rocks. If, however, we pursue our course to the southward of this range, more decided indications of active subterranean heat present themselves. Thus, on the eastern bank of the Irawaddi, we meet with vast springs of petroleum. These wells, which have long been celebrated, are three hundred in number, and the pits are from 200 to 250 feet deep. The supply they afford is immense. Earthquakes also occur in this region; thus, on the 23rd of March, 1839, a dreadful earthquake visited Ava. The bamboo and lighter buildings escaped, but in Ameerapoora, and the surrounding districts, all the brick buildings were thrown down, burying in the ruins several hundreds of the inhabitants. The earth was in many places rent into wide chasms, from whence issued torrents of water and gray mud, which emitted a strong sulphureous smell.

Bengal, again, we find to be subject to these dreadful visitations. In the year 1762, Chittagong was violently shaken by an earthquake, attended with many fearful phenomena, and much loss of life. This convulsion extended to Calcutta; and it is said that two volcanos burst out on the Seeta Cunda Hills.

Earthquakes are by no means unfrequent in Hindostan; and although no volcanos are known to exist in Central India, the buried cities in that region seem to indicate, that some very violent eruption must have occurred within the historical period. The city of Oujein was, about fifty years before the Christian era, the seat of empire, art, and learning. But according to tradition, this city, together with more than eighty other large towns in the province of Malwa and Bagur, was, in the time of the Rajah Vicramaditya, overwhelmed by "a shower of earth which fell from heaven." "That this was produced by a volcanic eruption," says Mr. Lyell, "appears very probable, although no information has been obtained

respecting the site of the vent; and the nearest volcano of which we read, is that which was in eruption during the Cutch earthquake in 1819—at least 300 geographical miles* from Oujein." The soil in which Oujein is buried, is described as being of an ash-gray colour, with minute specks of black sand. On digging to the depth of about fifteen feet, brick walls, pillars of stone, utensils of various kinds, and ancient coins, are found. A large quantity of wheat was discovered, almost entirely consumed, and in a state resembling charcoal. According to tradition, the course of the River Sipparah was changed at the same period.

A very severe earthquake occurred at Cutch on the 16th of June, 1819. The principal town, Bhooj, was converted into a heap of ruins, and the shock was very destructive at some other places. At Ahmedabad, the great mosque, erected by the Sultan Ahmed, fell to the ground; and the earthquake extended to Poonah, 400 miles distant. The shocks continued for four days, when the volcano Denodur, situated thirty miles north-west from Bhooj, is said to have burst forth in eruption, and the convulsions ceased.

This earthquake produced great and important changes in the delta of the Indus. The eastern channel of that river was, before this convulsion, fordable at Luckput, being only about a foot deep at low water; but after the shock, it was deepened to more than eighteen feet. And thus, this branch of the Indus, which had been closed for centuries, again became navigable. A depression or subsidence of land, took place at the village and fort of Sindree; the sea rushed in, and in a few hours converted a tract of land, 2000 square miles in area, into an inland sea, or lagoon. It is remarkable, that neither the movement of the earthquake, nor the rushing in of the water, entirely threw down the small fort of Sindree, one of the towers remaining almost uninjured; and the day after the earthquake, the inhabitants who had retreated thither were enabled to effect their escape in boats. A tract of land, fifty miles in length, and in some parts sixteen in width, was at the

* About 313 British statute miles.

same time elevated about ten feet above the plain. To this uplifted tract the inhabitants, to distinguish it from artificial mounds, gave the name of Ullah Bund, or the Mound of God. In 1828 Sir Alexander Burnes visited this spot, and went in a boat to the ruins of Sindree, where a single remaining tower was seen in the midst of a wide expanse of sea; the top of the wall still rising two or three feet above the level of the water. From this spot nothing was visible but an expanse of water, except in one direction, where a blue streak of land indicated the presence of the Ullah Bund. "This scene," observes Mr. Lyell, "presents to the mind a lively picture of the revolutions now in progress on the earth—a waste of waters, where a few years before all was land; and the only land visible, consisting of ground uplifted by an earthquake."

The province of Kumaon, in Northern Hindostan, is so subject to earthquakes, that the houses in Almorah, its chief city, are constructed on a particular plan to guard them from the impending danger, the lower stories being formed of stone, with a superstructure of wood. An earthquake of considerable violence was experienced at Lahore, in September, 1827. In the month of June, 1841, again, a severe earthquake occurred near Baban; by which houses and fortresses were levelled with the ground; and large masses rent from the adjacent mountains; the latter falling into the bed of the River Attock, obstructed the course of the stream, thus causing a calamitous inundation, by which several of the natives perished. It therefore appears that the region of earthquakes and volcanos traverses the whole of Hindostan; but to what extent it may be continued in the countries to the westward, is uncertain, some parts of those territories still remaining as blanks on our maps.

We also find that the valley of the Oxus is subject to these convulsions; and a short time previous to Sir A. Burnes' visit to that district, the whole basin of the river had been shaken by a tremendous earthquake, which destroyed several towns, and obstructed the course of rivers.

We now arrive at the Elburj range of mountains, where we meet with the elevated volcanic cone of Mount Demavend.

The whole country in the vicinity of this mountain, bears strong indications of violent volcanic action; strata of rocks being contorted and twisted about in all directions, and hot springs being very frequent in the surrounding districts. The mountain itself, although now externally extinct, still retains most decided evidence of internal heat. Its summit is formed of soft rock, in which is embedded a remarkable deposit of pure sulphur, supposed to be of very recent formation. In the interior of the caves, or recesses, from whence this sulphur is dug (which is effected with the assistance merely of a piece of stick), the temperature is described by Mr. T. Thomson, who visited the spot in September, 1837, as being so high, that his hand would not bear exposure to the hot current of air which flowed from the interior of the rock.

We have now arrived at the volcanic region which occupies the country round the Caspian Sea; and again enter into one of the more marked volcanic bands—the volcanic region from the Caspian to the Azores.

The volcanic region from the Caspian to the Azores, extends from east to west, for the distance of about 1000 geographical miles*; including within its limits, the Mediterranean Sea, and its most prominent peninsulas. From north to south, it extends from about the thirtieth to the forty-second degree of north latitude. Its northern boundaries are the Caucasus, the Black Sea, the mountains of Thrace, Transylvania, and Hungary; the Austrian, Tyrolese, and Swiss Alps; the Cevennes and Pyrenees. The southern boundaries of the region include the countries bordering on the Tigris and Euphrates, Palestine, and part of Arabia, the most northern parts of Africa, and the Canary Islands. Throughout the whole area comprehended within these extensive limits, we may trace numerous points of volcanic eruption, hot springs, gaseous emanations, fountains of petroleum, and other signs of igneous agency; whilst few tracts of any extent in this region, have been entirely exempt from earthquakes, within the last three thousand years.

* About 1150 British statute miles.

The country between the Caspian and Black Seas, exhibits very marked indications of energetic subterranean heat. In this region, near Baku, in Azerbijan, is situated the remarkable tract, called the Field of Fire. This consists of a hollow expanse, full of fissures, from which an inflammable gas continually issues, producing a blue flame. This was the native land of Zoroaster, and in ancient times, formed one of the most celebrated "Shrines of Grace," among the Ghebers, or fire-worshippers, who erected their temples over these natural springs of fire. In the same district, numerous mud volcanos occur; and volcanic eruptions have taken place in the years 1830 and 1840. The latter eruption, which occurred on the 7th of February, commenced about midnight, and was accompanied by a loud subterranean noise, which was heard at the distance of twenty miles. Numerous fissures were formed, and lava thrown up, whilst the flames which issued from the ground, were visible at the distance of twenty-five miles from the spot. A dense black smoke, which rose like an immense column, was driven like a thunder-cloud before the wind, depositing in its course a great number of small globules, resembling shot, composed of the burnt matter and sulphur. The ground was violently agitated during the whole of the succeeding day, and the atmosphere, to a considerable distance round, was impregnated with sulphur. In this district, we also meet with inexhaustible springs of naphtha, which yield daily 1000 pounds' weight; and no sooner are the wells, or pits, emptied, than they are instantly replenished. As this mineral oil, from its lightness, floats upon water, and will burn freely on its surface, the inhabitants on the borders of the Caspian, frequently in calm weather form a splendid exhibition, by pouring whole tons of it into that sea; being then set on fire, and borne upon the surface of the waves, it presents the appearance of a sea of flames.

The countries bordering on the Euphrates and Tigris are equally abundant in naphtha, as well as in the different varieties of the same substance, asphaltum, petroleum, and bitumen. This territory includes the ancient "plain in the land of Shinar;"

The plain wherein a black bituminous gurge
Boils out from underground, the mouth of hell,
Of brick, and of that stuff, they cast to build
A city and a tower, whose top may reach to Heaven.

In this plain, about six miles from the site of ancient Babylon, Mr. Rich mentions that a vast heap of ruins is still to be seen, supposed to be the remains of the Tower of Babel. On the summit, is a solid pile of brickwork, much shattered, and rent by a large fissure. Around the pile lie huge fragments of brickwork, confusedly heaped together, and converted into solid vitrified masses, as though they had been exposed to the action of intense heat. This heap of ruins is known by the name of the Birs Nimrood.



"The never-failing fountains of bitumen, famed of old, and situated near the ancient and celebrated city of Hit, which were visited by Alexander the Great, and at a latter period by the Emperor Trajan, still continue, as they did in those days," says Colonel Chesney, "to be employed as pitch to cover the gopher boats of the Euphrates, and the asphaltic coracles of the Tigris."

Every part of this region, from the borders of the Euphrates to the Caspian, and from thence to the Black Sea, is very subject to earthquakes. The same remark applies to the Caucasian district, which also abounds in hot springs and in mineral waters. The whole country round Ararat rests, as we have seen, on a basaltic base, and both that mountain, and Sevellau, have long been considered as the cones of extinct volcanos; and the recent terrible convulsion, which has shaken Mount Ararat, proves that subterranean heat still continues in great energy in this region. On the 2nd of July, 1840, the shock of an earthquake, which lasted for one minute, was felt in Armenia; being particularly violent in the districts of Scharour, and Sourmala, where all the villages were destroyed. Vast masses of earth, stones, and ice, were precipitated from Mount Ararat, beneath which the village of Akhoura, with all its inhabitants, was totally buried. Torrents of melted snow also poured down from the mountain, devastating the fields and orchards, to the distance of seven miles. Slight shocks continued to be felt in the environs of Ararat, until the 8th of July, the severest recurrence of these convulsions having been on the 6th, when immense masses of rock were again detached from Mount Ararat, and a vast torrent of melted snow again poured down from the mountain, which, rushing down with extraordinary rapidity, destroyed in two minutes everything in its way, so that there remained no trace of the previously flourishing fields and orchards for the distance of nearly fourteen miles. Thus, in 1817 an eruption of this description took place, when in the course of eighteen days, a mass of mud, 868 feet in height, was formed.

In the Sea of Azof, again, volcanic eruptions have occurred within a recent period; a submarine eruption, accompanied with loud detonations, emission of fire and smoke, and the throwing up of stones, having taken place in 1799, and a new island having been formed in the same locality by volcanic eruptions, in the year 1814.

Syria and Palestine abound in volcanic appearances. Between the River Jordan and Damascus, lies a volcanic tract,

which is described as composed of nothing but lava and other volcanic products; small craters and fearful fissures are also numerous; and travellers declare, that there are evident signs of the whole country having been formerly filled with volcanos. The whole region round Lake Asphaltites, or the Dead Sea, likewise bears the strongest indications of volcanic action. Very extensive areas of this region have also, at various periods, been convulsed by earthquakes, attended with great destruction of cities and loss of life. Continual mention is made in history of the ravages committed by earthquakes in Tyre, Sidon, Berytus, and other places. An earthquake is mentioned by the prophet Amos, as occurring in Judea in the time of Uzziah, B.C. 791; another is mentioned by Josephus, as having happened during the reign of Herod the Great, B.C. 31. And, within a very recent period, violent convulsions have agitated the whole region. Thus, in 1822, Aleppo was almost destroyed by an earthquake, the effects of which were felt from Diarbekr to the island of Cyprus. Another great convulsion took place on the 1st of January, 1837, which extended 500 miles in length and 90 in breadth, and totally destroyed Tiberias, and laid many other towns and villages in ruins. It was observed, that after this earthquake, the temperature of some springs in this territory was greatly augmented.

In Asia Minor we again meet with marked indications of volcanic agency; volcanic cones occurring in various parts, and hot springs being very numerous. Among the former is the extinct crater of Mount Argæus, which rises up abruptly from a broad extended base, to almost a single peak, 13,000 feet above the sea. Perhaps, however, the traces of igneous action most remarkable on account of their classical interest, are three extinct craters, situated in tract called by the Greeks Katakekaumene, or the Burnt Region, and which correspond to some volcanic vents described by Strabo as "three pits which are called bellows." This tract, which consists of a large territory with an arid and cindery soil, is situated in the south-western part of Asia Minor. The whole of this region is also subject to

earthquakes. Thus, in September, 1754, a severe convulsion agitated nearly the whole of Asia Minor, having been felt simultaneously at Sivas on the borders of Armenia, and at Constantinople. The former city was engulfed, and a lake formed on its site. It was also felt at Angora, and very severely in Nicomedia; and, though more slightly, along the whole southern coast, and at Smyrna. It extended to Constantinople, and even to Alexandria and Cairo, or Kahiro, in Egypt; proving exceedingly destructive at the latter place, where it threw down many buildings, burying great numbers in their ruins.

We next arrive at the Grecian Archipelago, where the island of Santorini forms the grand centre of volcanic action, and where, at various periods, new volcanic islands have risen from the sea. The island of Milo also contains a volcano of recent aspect, having a very active solfatara in its crater, and many sources of boiling water. These islands are also subject to earthquakes. In March, 1755, Mitylene was visited by a very severe convulsion, by which two thousand houses are said to have been thrown down, and great numbers of the inhabitants killed.

Many severe earthquakes are on record in the Morea,—Sparta having been laid in ruins by one of these convulsions in the year B.C. 469. In more recent times, we find that in July, 1754, the coast of the Morea was visited by a severe earthquake, when several populous villages near Lepanto were swallowed up. A severe earthquake also occurred in the island of Cerigo in 1754.

The Ionian Isles are almost continually convulsed: in the year 1820, after a severe earthquake, a new rocky island made its appearance near Santa Maura; and on the 31st of October, 1841, a disastrous earthquake occurred at Zante, which did great damage, destroying the castle and town, and depriving many persons of life, and causing the disappearance of a small island in the harbour.

We have already alluded to an earthquake which was experienced at Constantinople, in September, 1754, at which

place it was very severe, and did much injury to the city and the suburbs. Macedonia, Thrace, and Epirus, have always been subject to earthquakes; and in October, 1837, a convulsion of sufficient severity to throw down several houses, and by which many lives were lost, was felt at Agram, and throughout the whole of Croatia. Istria, again, is subject to these disturbances; and in the year 1751, three parts of the city of Fiume were swallowed up by an earthquake; and a little island off the coast, with all its inhabitants, totally disappeared, not a vestige being visible on the following day.

The latter districts, however, are situated rather to the northward of the marked volcanic band, and yet more so is the town of Bonneville, near which a remarkable convulsion occurred in July, 1751. A sudden subsidence took place in the mountain of Plainejou, large masses of rock being at the same time precipitated into the adjoining valley. The mountain itself was observed to be covered with cinders and ashes; and from two vents about a quarter of a mile apart, thick columns of smoke issued, emitting a strong sulphureous smell, occasionally accompanied by flame.

The energetic volcanic action displayed in Southern Italy, Sicily, and the Lipari Isles, is well known. The volcanic district of Italy extends from Cape Campanello to the River Ombrone, south of the Bay of Naples; but, excepting near its southern extremity, external volcanic action has long been extinct. Volcanic products and gaseous exhalations, however, occur in various parts. Among the latter are the Grotto del Cane, and the Lago Amsanto. The ancient Alban Mount is of volcanic formation, and the Alban Lake occupies the crater of an extinct volcano. The

Seven Roman hills, the world's seven wonderments,

are also of similar composition.

The district of active volcanos extends from Vesuvius, through the Phlegrean fields, to the islands of Procida and Ischia. Within this space, the volcanic energy is sometimes developed in smaller eruptions from a considerable number of scattered points, though the greater part of its action has been

confined to one principal vent, Vesuvius, or Somma. Before the Christian era, this principal vent appears to have been in a state of inactivity; but terrific eruptions took place in the islands of Ischia and Procida. In Ischia there are no less than twelve considerable volcanic cones, which have been thrown up since the island was raised above the surface of the deep.

The ancient cone of Vesuvius is described as having been of very regular form, terminating with a flattish summit, where might be seen the remains of an ancient crater, nearly filled up, but leaving in its interior a slight depression, which was covered with vines, having an arid plain, however, at the bottom. The exterior flanks of the mountains were clothed with fertile fields, richly cultivated; and at its base were the populous cities of Herculaneum and Pompeii. But this scene of repose and fertility was doomed to cease. After a series of earthquakes, which lasted for sixteen years, the volcano burst forth in a most tremendous eruption in August, A.D 79 *. Since that period, eruptions have taken place from time to time. A long pause, however, occurred between 1306 and 1631; but, during this interval, Monte Nuovo in the Phlegrean fields was formed. This took place in 1538.

During the above-mentioned interval of rest, Vesuvius had again become clothed with vegetation, again the abode of cattle and wild animals. But in the year 1631, another tremendous eruption occurred, when the town of Resina, built partly over the ancient site of Herculaneum, was overwhelmed by a current of lava. From that period to the present time, there has been a constant series of eruptions, with rarely an interval of rest exceeding ten years.

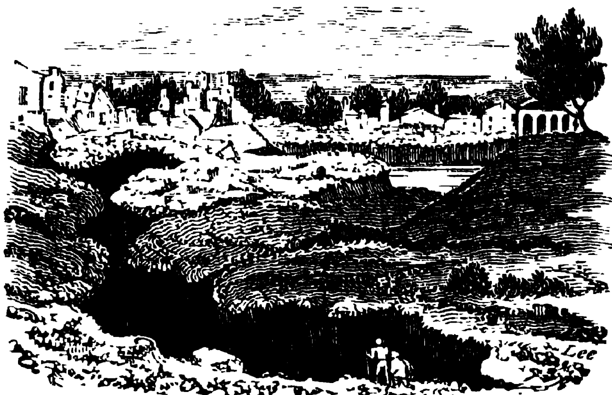
The great crater of Vesuvius, from the end of the last century to the year 1822, had been gradually filled up, partly

* It was on this occasion that the elder Pliny perished, by venturing too near, to obtain a view of the phenomenon. The guides informed an English traveller, who visited this spot some years back, that a milorde Inglese had been suffocated there. On inquiring his name, the reply was, they believed it was my Lord Plinio!

by lava boiling up from below, and partly by volcanic cinders ejected from minor vents on its sides. And thus, instead of a cavity, the summit consisted of a rough and rocky plain, covered with blocks of lava and scoriæ, and intersected by numerous fissures, from which clouds of vapour were evolved. By the tremendous eruption of October, 1822, the structure of this was wholly changed: violent explosions, which lasted more than twenty days, broke up, and threw out all this accumulated mass, leaving an immense gulf, of an irregular, but somewhat elliptical shape, nearly three quarters of a mile in diameter. The depth of this tremendous abyss has by some been considered to have measured, when first formed, 2000 feet from the extreme summit; though other accounts assign less than 1000 feet for its depth. The sides of this gulf have been continually crumbling away from the time of its formation, so that its depth is perpetually decreasing. By this convulsion, the cone of Vesuvius lost 800 feet of its elevation, having been reduced from 4200 to 3400 feet above the sea.

Calabria is subject to terrible earthquakes. A most tremendous convulsion occurred on the 5th of February, 1783, when the first shock threw down, in two minutes, the greater part of the houses in all the cities, towns, and villages, from the western declivities of the Apennines in Southern Calabria, (or Calabria Ultra,) to Messina in Sicily, and convulsed the whole surface of the country. Another shock, of nearly equal violence, occurred in March, and during the year 1783, the total number of shocks was 949; nor did the convulsions cease, until the end of the year 1786, having lasted nearly four years. Various physical changes occurred in the surface of the country; a subsidence took place in the quay at Messina; deep chasms and fissures were found in many places. The latter were almost innumerable near Polistena. One fissure (represented in the cut) was of great length and depth; and the level of the corresponding sides was greatly changed in some parts.

Numerous landslips also occurred: in one instance a small



Fissure near Polistena.



Circular Hollows in the Plain of Rosarno.

inhabited house was carried down entire, with the mass of earth on which it was standing, without injury to the inhabitants. The olive trees also continued to grow on the land, which had slid down into the valley, and bore the same year an abundant crop of fruit. Fifty lakes were also formed, one of which was about two miles long and a mile broad, and of great depth. But perhaps among the most singular effects of this convulsion, was the formation of small circular hollows in some of the plains. These hollows are described as having been about the size of carriage wheels: they were sometimes filled with water, but more frequently with dry sand, and, on digging down, they were found to be funnel shaped.

Forty thousand persons are said to have perished by this dreadful catastrophe; and nearly half that number subsequently, owing to the privations they were compelled to endure, and the epidemics caused by the stagnant water, in the numerous newly-formed lakes and ponds.

Calabria was visited by a series of earthquakes, though of comparative unimportance, in the months of October and November, 1841. These convulsions extended to Sicily. Etna appears to have been in activity from the earliest times of tradition; and sixty-nine great eruptions of this volcano are on record, the most recent of which occurred in November, 1832. This mountain, which towers to the height of 10,963 feet, is chiefly composed of volcanic matter; but the sides are in many parts richly covered with vegetation, to within about 1100 feet of its extreme summit. In this part spreads the desert plain, consisting of a waste of black lava and scoriæ, from whence the principal cone rises. Near the base of this cone, occurs the remarkable phenomenon of a mass of ice, preserved under a layer of lava.

The grandest and most original feature in this volcanic mountain, is the multitude of minor cones, which are distributed over its flanks, and which are most abundant about half way up the mountain. Without enumerating numerous small mounds of ashes, where lesser vents have been opened, there are about eighty of these secondary cones, of considerable

dimensions. One of the largest, Monte Minardo, near Bronte, is upwards of 700 feet high. Some of these cones have, however, lost much of their original height, by the surface round them having been filled up by volcanic matter, ejected by subsequent eruptions from more elevated vents.

The last considerable eruption, which took place in 1832, was of very fearful aspect, though happily unattended with loss of human life. The city of Bronte was threatened with destruction; a vast stream of lava, a mile in width, and thirty feet in depth, having taken the direction of that city: this stream moved majestically onwards, at the rate of about three quarters of a mile a day, and had approached within two miles of Bronte. The city, however, was spared; the lava stream, at this point, was arrested in its progress, and the greater part was received into a large fissure or gulf, formed by some previous convulsion.

A volcanic island was formed in the year 1831, between the coast of Scily and the small island of Pantellaria. It received various names, among others, that of Graham's Island; but was of very temporary duration. Although Malta is not volcanic, there appears reason to conclude that the adjacent small island of Gozo is of volcanic origin.

The Lipari Islands are all composed of volcanic rocks. Stromboli consists of a single conical mountain, having several small craters, all of which, with a single exception, are at present extinct; but this active vent is remarkable for its perpetual energetic action, no cessation whatever in its activity, having been known to have occurred for the last two thousand years.

In its prolongation westward, the volcanic region passes through Spain and Portugal, the southern parts of both which countries have at various periods suffered severely from earthquakes; and on the 7th of August 1841, the shock of an earthquake was felt extensively throughout Spain. Lisbon was violently agitated on February 2nd, 1816; but the most tremendous earthquake, in modern times, was that experienced in the latter city in November, 1755. A sound resembling

subterranean thunder was heard: this was immediately succeeded by a violent shock, which laid in ruins the greater part of the city, and overwhelmed a fearful number of its inhabitants. The sea first retired to a considerable distance; then, rolling in, it rose fifty feet above its ordinary level, and the mole, with all the unfortunate persons who had hurried thither for safety, sank suddenly below the waters to the depth of several hundred feet. A considerable number of English merchants resided in the city, but of these a very small number perished; for this dreadful calamity occurred on All Saints' day, which, being a Roman Catholic festival and public holiday, the British residents were mostly absent at their villas in the vicinity of the city, and thus providentially escaped. The circumstance of its happening on this day, however, added greatly to the general calamity; for the numerous lights which were, in consequence, burning in the city, caused a very destructive conflagration, which incalculably increased the misery and loss of property among the unfortunate inhabitants.*

The volcanic band extends also across the northern part of Africa, especially in Algiers and Marocco, which have at various times experienced earthquakes simultaneously with Spain and Portugal. Thus, the memorable earthquake of November 1st, 1755, was also felt in great violence in Barbary; and, on the 19th of the same month, the city of Mequinez was buried in the earth by a violent convulsion, which also swallowed up two large encampments of wandering Arabs, consisting of eight or ten thousand persons, together with the whole tract of ground they occupied. Nearly half the city of Fas, or Fez, was likewise destroyed, and the neighbourhood of Marocco suffered greatly.

The Azores are considered as the continuation of the volcanic band, of which they perhaps form the termination, though it is uncertain whether Madeira, and the Canaries, may

* As we have given many particulars of the Lisbon earthquake in our *Recreations in Geology*, to avoid repetition, we omit further notice in this place.

not communicate beneath the waters with this great region. The Azores are all of volcanic origin; and, although no active vents exist in these islands, there is strong evidence of internal volcanic energy. Hot spring and gaseous exhalations abound; and a temporary volcanic island, to which the name of Sabrina was given, was formed off St. Michaels in 1811. These islands are also subject to earthquakes; a severe convulsion occurred in July, 1757, which violently agitated Terceira, but proved more destructive in some of the other islands. On this occasion, eighteen small islands are said to have been formed off the northern side of St. George's Island; whilst, in other parts, huge masses were detached from the shore, and carried out to sea. The frowning cliffs, in some instances, were so shattered and laid low, that spots formerly inaccessible, became easy of approach, and the means of communication thus opened between some of the islands, where access was previously impracticable.

We have already adverted to the supposed progressive westerly course of some great earthquakes, which occurred in the fourteenth century. A somewhat similar phenomenon appears to us to have been strikingly displayed in the middle of the last century, in the volcanic region we have now been considering. The series of convulsions to which we allude, though not absolutely regular in its westerly progression, yet, evidently had a general direction from east to west, extending from the borders of Armenia to the Azores.

As we have already had occasion to mention the greater number of these convulsions, we will here briefly enumerate them in chronological order.

The first indication of these violent subterranean disturbances, was exhibited at one of the principal vents, Mount Etna; where, in June, 1754, after some very severe earthquakes, by which two villages were swallowed up, a violent eruption occurred. On the 15th of July, of the same year, a severe earthquake (already mentioned) proved very destructive in the Morea, especially near Lepanto. On the 2nd of September following, the tremendous earthquake occurred, which com-

mencing at Sivas, on the borders of Armenia (or perhaps still further eastward), convulsed the greater part of Asia Minor, extending also into Egypt, and doing much injury in Constantinople. At the latter city, the movement of the convulsion was observed to have a direction from east to west. On the 4th of December, of the same year, a violent eruption took place in Mount Vesuvius, two streams of lava, one of which was a mile in breadth, having burst forth, threatening destruction to the surrounding country.

On the 2nd of March, 1755, Etna was again in eruption, two streams of lava having poured from the highest crater, which was covered with snow, but which the fiery torrent suddenly dissolved, thus producing a frightful inundation. The convulsions in the more eastern part of this disturbed region, do not, however, appear to have wholly subsided; for, in the same month, the severe earthquake already alluded to as convulsing Mitylene, occurred in that island. Towards the end of this year, however, these tremendous disturbances approached the western confines of Europe and Africa. The convulsions swept across Sardinia and Corsica, agitated the greater part of Spain and the whole of Portugal, and, on the 1st of November, laid the city of Lisbon in ruins. The north-western parts of Africa, as we have already seen, were simultaneously convulsed; and, on the 19th of the same month, an earthquake proved terribly destructive in that region. The movement on this occasion was also from east to west; and is said to have travelled at the rate of twenty miles a minute.

After the terrible convulsion above mentioned, a longer pause appears to have ensued; but in July, 1757, the violent earthquake occurred, of which we have already given some description, as proving very destructive in the Azores; which appears to have terminated this remarkable series of disturbances: and which, it will be observed, traversed the tract we have mentioned, as forming the central line of the volcanic region, from the Caspian to the Azores.

The *Icelandic volcanic region* is a much less extended group, and may be considered as comprehending Iceland, Jan

Mayen's Island, and part of the coast of Greenland*. The latter is subject to earthquakes, and Jan Mayen's Island contains a volcano, but Iceland constitutes by far the most important feature in this volcanic region.

Iceland, as far as has been observed, is wholly of igneous formation. It is subject to violent earthquakes, contains some of the most remarkable boiling springs in the world, and its volcanos are prodigiously active, and have been, at intervals, in violent activity from the earliest period of the discovery of this island. Among the volcanos of Iceland, Hecla appears to have been the most regular in its eruptions, and twenty-two formidable ones have been recorded, as occurring within the last eight hundred years; and, during the same period, twenty violent eruptions have taken place in the other Icelandic volcanos. So intense is the energy of subterranean heat in this cold region, that some eruptions of Hecla have lasted for six years without ceasing. Earthquakes also have shaken the whole island at once, causing great changes in the interior, rending mountains, causing hills to sink down, changing the courses of rivers, and forming lakes. New islands have also been thrown up off the coast, some of which have been permanent, but others have disappeared, either by subsidences, or by the action of the waves. An island of this description was formed in 1783, and was formally claimed by the King of Denmark, who conferred on it the name of Nyoe, or the New Island; but ere a year had elapsed, nothing was left, save a reef of rocks from five to thirty fathoms under water.

On of the most tremendous eruptions on record in Iceland, was that of the Skaptàr Yokul, which commenced on the 11th of June, 1783, and did not entirely cease for two years. The immensity of the volume of melted matter ejected on this occasion, renders this eruption very remarkable. Two streams

* From the continuous form observable in the outline of Greenland and the eastern shores of North America, and from the linear direction, bearing a general correspondence with the form of the coast, so frequently met with in volcanic regions, we should have been induced to place Canada in the Icelandic volcanic region; but we are not aware that any actual observations warrant this conclusion.

of lava flowed in opposite directions, one of which extended fifty miles, and the other forty miles in length. The width of the first stream was about twelve or fifteen miles, that of the latter about seven; the ordinary height of both currents was about one hundred feet. The lava flowed into the deep channel of the River Skaptâ, and thus diverted it from its course; in consequence of which destructive floods ensued, which were greatly augmented by the melted snow that poured down from the mountain. The channel of the Skaptâ was between rocks, from 400 to 600 feet in depth, and nearly 200 in width; and not only did the lava fill up this great defile to the brink, but overflowed the adjacent fields to a considerable extent. The lava, after flowing for some days, was precipitated down a tremendous cataract, called Stapafoss, where it filled a profound abyss, which that great waterfall had been forming for ages. The loss of life and property was very great; twenty villages were destroyed, and above nine thousand persons perished, together with an immense number of cattle. The waters off the coast of Iceland, also, were so impregnated with the sulphureous exhalations, that the fish deserted the coast, a circumstance that added greatly to the distress of the inhabitants, who depend, in great measure on the produce of the sea for their support. Iceland has scarcely to this day, recovered from the effects of this fearful calamity.

Beyond the limits of these volcanic regions, all countries are subject to slight tremors, at distant intervals of time. Slight shocks have frequently been felt in the British Isles, in France, Germany, and other parts of Northern Europe; but these countries cannot be considered as constituting parts of either the Southern European, or of the Icelandic, volcanic regions. In many instances, these tremors appear to be mere vibrations, produced mechanically, through the external crust of the globe, and originating in some great convulsion in an adjoining volcanic region. Such were the agitations experienced in these islands, and over a considerable portion of Europe, during the great Lisbon earthquake. In other instances, however, these agitations appear to be independent of any such

great convulsion. The year 1750 appears to have been marked by several commotions of the latter description, occurring in the countries of Europe, situated beyond the volcanic region. In the course of that year, a severe shock of an earthquake was felt at Munich, and in the surrounding country; numerous shocks were also experienced in France, particularly at Bordeaux, Toulouse, Narbonne, Montpelier, &c., though the shocks were most violent near the Pyrenees, where several houses were thrown down, and many persons killed.

In the same year, two smart shocks were felt in London and its vicinity. The first took place on the 8th of February, and was felt in all parts of the metropolis, as well as at Hampstead and Highgate, and along the banks of the Thames, from Greenwich to Richmond. It was particularly violently at Limehouse and Poplar, where, as well as in Leadenhall-street, some chimneys were thrown down; and, in several parts of the city, the pewter platters (then in use) fell from the shelves. The second shock occurred on the 8th of March, and was more violent, and of longer continuance, than the former. This took place at half-past five o'clock in the morning; and many persons quitted their beds, and ran into the streets in the greatest consternation. It, however, was attended with no loss of life, although several chimneys were thrown down, and some houses injured. It was particularly violent in the neighbourhood of Grosvenor-square, the copper and pewter utensils in the kitchens having been thrown off to some distance from the shelves. In St. James's Park, the ground is said to have heaved perceptibly. It extended to some distance round London, having been felt in parts of Kent, Surrey, and Hertfordshire. So great was the panic in the metropolis, that many persons, dreading a repetition of these convulsions, quitted London, shutting up their houses and shops, and seeking refuge in the country. No third shock, however, appears to have occurred in the metropolis; but, during the same year, slight shocks were felt in various parts of England.

During the month of October, 1839, several shocks of

earthquakes were felt in various parts of Scotland. Although not severe, they were sufficiently so to cause some alarm; they occurred on the 7th, 10th, 13th, 14th 16th, and 23rd days of October. The bells were set ringing; persons seated in chairs could with difficulty retain their seats, and stone dikes or walls were thrown down. But the most serious injury caused by this agitation of the earth, was the bursting of the Easeburn reservoir, on the banks of the River Carron, the waters of which swept over the adjacent lands, bearing every transportable article before them, and even rooting up young trees. Shocks of earthquakes have also occurred in Scotland, both in 1840 and 1841.

Compared, however, with the fearful effects of subterranean heat displayed in the volcanic regions of the earth, these tremors appear of trifling importance; and although we may be ready to trust that, in the vast system of nature, these terrific convulsions may be beneficial, and knowing that all "partial evil" is "universal good," we cannot but feel thankful that our highly-favoured country is happily exempted from these appalling and destructive visitations.

But shouldst Thou wreck our father-land,
And mix it with the deep,
Safe in the hollow of Thy hand,
Thy little ones would sleep!

CHAPTER XVIII.

GENERAL FEATURES OF AFRICA.—AFRICAN ISLANDS.—AFRICAN VOLCANIC REGION.

O'er Africa the morning broke;
And many a negro land revealed,
From Europe's eye and Europe's yoke,
In Nature's inmost heart concealed.

MONTGOMERY.

THE vast peninsula of Africa presents some very striking natural features. A large portion of this division of the globe

is situated within the tropics; and its extreme northern and southern limits are nearly at an equal distance from the equator. If, therefore, general uniformity of climate depended solely upon latitude, we might expect to meet with great similarity in this respect in all parts of Africa. It, however, appears, that the other conditions producing diversity of climate—such as the alternations of highland and lowland, the absence or presence of rivers, the inequality of the mass of land, and consequent remoteness from, or proximity to, the ocean—are exhibited on a large scale in these extensive regions, causing great variety of temperature and fertility.

The whole northern portion of Africa, with the exception of the eastern extremity, is occupied by the extensive range of the Atlas Mountains, and their various branches. These mountains, which in some parts rise above the snow-line, give origin to several rivers and streams, which find an outlet either in the Mediterranean Sea, or the Atlantic Ocean; and although, from the proximity of these mountains to the shores these streams do not form important rivers, they fertilize the rich plains of Barbary and Marocco. Another great mountain system of Northern Africa, consists of the lofty ranges of Samen and Taranta, which are prolonged in the Donga Mountains, or Mountains of the Moon, extending far into the interior, and forming a succession of elevated terraces and table-lands, throughout Abyssinia and the adjacent country. The Mountains of Abyssinia, or Geesh, estimated at fifteen thousand feet above the sea, appear to form the most elevated portion of this range.

The central part of Africa is very little known; but the greater portion of that region is supposed to be occupied either by mountains or by elevated plateaus; an inference drawn from the occurrence of numerous important rivers, which are either known, or considered, to take their rise in those regions. Among these, we may mention the Nile, which takes a northerly course; and the Senegal, the Quorra, and various other rivers, which empty themselves into the Atlantic Ocean.

The easterly portion of Africa is scarcely better known than

the interior, but a range of mountains, more or less continuous' is supposed to extend from Abyssinia to the southern extremity of Africa. The latter region is occupied by mountains of inferior elevation to those of Northern Africa, but which, nevertheless, do not fail to produce very important modifications in the climate and temperature of the country. The most elevated are perhaps the Nieuveldt Mountains, which in some parts are considered to reach the height of ten thousand feet above the sea, and present some snow-capped summits. The Kous Mountains, which separate Caffraria from the Bechuana country, do not appear to exceed six thousand feet in height; and the Cedar Mountains, with their prolongation, the Kamies or Lion Mountains, range from one thousand six hundred to five thousand feet above the sea level. The Cedar Mountains are described by Sir James Alexander as being very beautiful, with a highly picturesque outline, and adorned with great numbers of the cedar of Lebanon, which tree here attains a magnificent size, and with which these mountains were formerly covered. Marine fossils are found in this range, at the elevation of two thousand feet above the sea; and fine jasper, agates, and garnets, are of frequent occurrence. The extreme south is occupied by the conspicuous, though not very elevated mountain group, which rises immediately above Cape Town, and which includes the precipitous table-mountain, 3580 feet above the sea, and its two supporters, called the Devil's Head, and the Lion's Head.

In Western Africa we meet with the Qua Mountains, and the Rumli range; the former being about five thousand, and the latter three thousand feet, in general elevation. The most lofty mountain in this portion of Africa is the Peak of Cameroon, which attains the height of thirteen thousand feet above the sea, and is covered nearly to the summit with trees of luxuriant growth. This elevated mountain is situated at no great distance from Fernando Po, in which island, the lofty summit of Clarence Peak reaches the height of ten thousand feet. Between Fernando Po and the mainland, there is a depth of forty fathoms; and this locality appears to present one of the most

remarkable undulations on the surface of the globe. The Kong Mountains, which commence at Cape Verde, and from the southern boundary of the Sahrà, extend to an unknown distance in the interior.

The most striking feature, however, in the natural geography of Africa, is the great extent of desert occupying various portions of this region, and which, for the most part, is without elevated land, and destitute of streams of water. The deserts of Northern and Southern Africa, however, although they may agree in their general character, differ very considerably in their particular features. The Sahrà, or Great Desert, as before observed, with the exception of an occasional wady, or oasis, consists chiefly of low rocky hills, and boundless extents of moving sands, parched and pulverized by the intense heat of a tropical sun. "There," says Captain Belcher, "the very atmosphere is sand; the grains of drift-sand varying in size, from an almost inpalpable powder to that of hemp-seed." "I found," continues the same officer, speaking of the country round Cape Blanco, "the grains equal to dust shot, almost insupportable; but what must a gale of hemp-seed size prove?" Such, however, is the nature of this vast desert, which covers an area nearly three times as great as that of France, and which extends from the shores of the Atlantic to the borders of Egypt.

In such a country, where there is

No shade, all sun, insufferably bright,

we shall not expect that animal life will appear in the same exuberance as in well-watered lands, situated in parallel latitudes; and, in fact, we find that, with the exception of an occasional troop of gazelles (fig. 90), or of ostriches (fig. 128) occurring on its outskirts, or perhaps a few jerboas (fig. 50), and similar animals, in the vicinity of the wadys; to which may be added a small number of beetles, and other insects adapted to indure the scorching heat of these arid sands; the Sahrà may be said to be entirely destitute of inhabitants. As we approach the borders of Egypt, the wadys become more frequent and of greater extent; and at length on the borders of the Nile, the desert tract is changed into one of the greatest

fertility. The occurrence of these wadys, or oases, wherever springs exist, leads to the conclusion, that the sterility of the Sahrà arises from no peculiarity of the soil, but from the absence of water; there being no rivers to irrigate and fertilize the western portion of this belt, and rain being almost unknown in its whole extent. This deficiency of water arises in great measure from the configuration of its surface, and its want of trees. We have seen that mountains and trees attract and condense moisture, and, as this region, in its interior, is destitute of both those requisites, the few clouds which may be wafted across it from the Atlantic, become rapidly dispersed by the intense heat, and do not descend in refreshing showers.

Between the Sahrà and the Atlas Mountains, extensive districts are covered by the date-palm (fig. 175), an abundant supply of food being thus bountifully provided, for the inhabitants of the territory bordering on that desolate waste.

The deserts or karroos of Southern Africa, differ widely from the Sahrà, approaching rather in character to the steppes of Northern Asia. This difference is attributable, partly to the undulations of the surface in Southern Africa, and partly to the greater proximity of every portion of this region to the waters of the ocean; in consequence of which, these districts receive abundant supplies of rain. These rains are, however, periodical, and the karroos experience a *dry season*, at which time all vegetation disappears. Like the Sahrà they possess a sandy soil, but this, instead of presenting a moving surface, is firmly bound together by the fibres and roots of various plants, which at all times derive a certain supply of nourishment from the soil; but which in the rainy season, spring up, and cover the whole country with rich and spontaneous verdure. These karroos are not, therefore, like the arid Sahrà, unsuited for the support of animal life; but, on the contrary, are peculiarly adapted for the temporary sustenance of such graminivorous animals, as possess sufficient speed of foot, to enable them to traverse a considerable extent of country in search of congenial food. And, accordingly, we find that the Creator has adapted the animal to the vegetable productions of this region; for no

country abounds so much as does Southern Africa, with vast herds of gazelles, spring-boks, and other species of antelopes.

A large portion of Central Africa, being wholly unknown to Europeans, we cannot attempt to trace even an outline of the interior districts; though under this head we may, perhaps, not inappropriately, consider the fertile regions situated to the south of the Sahra, to which latter, this portion of Africa presents a strong contrast. This difference is, however, readily accounted for by the different nature of the surface; the regions we are now considering being traversed by lofty mountain ranges, which give rise to numerous magnificent rivers, and diffuse both coolness and moisture over the whole district; thus rendering it one of the finest countries on the face of the globe. These mountains approach the Atlantic near Sierra Leone, which place has received its name from the lofty peaks in that vicinity, these being called the Sierra Leone, or Mountains of the Lions. Another branch, which extends to Kong, terminates with a lofty cone, near which is a productive gold mine. This mountain system stretches into the interior, presenting a varied and picturesque aspect, and giving rise to the rivers Senegal and Gambia, whilst the Quorra flows through the deep valleys. These mountains appear to attain their greatest height in the kingdom of Bornou, where they are supposed to extend southwards, and probably to reach a considerable elevation, several remote peaks resembling the aiguilles of Mount Blanc, having been seen in the distance.

The general character of the valleys and plains in this region is that of beauty and fertility. Watered by tropical rains, and intersected by numerous streams, vegetation in this zone becomes exuberant in the extreme. The borders of the rivers are enriched by fine woods; and rice, or wheat, according to the nature of the surface, are cultivated with great success. In Bornou, however, these useful grains are entirely superseded by a small species of grain, termed *gussub*, held in great esteem among the natives. Some districts, among which is the country of Zegzeg, not only yield plentiful crops of grain, but are also described as covered with fine pastures, and

as being beautifully varied with hill and dale, resembling the finest parts of England. All parts, however, are not quite so delightful, some spots, especially, the vicinity of the Lake Tchad, which periodically overflows its banks, and is covered with impenetrable thickets, and rank grass of remarkable height, the resort of numerous elephants, lions, panthers, hyænas, &c.

Gold occurs very abundantly in this part of Africa, especially in the district of Ghonah, where large quantities are found in all the plains, banks of rivers, rocks, and stones.

Having considered the interior of this continent as far as our limited means will enable us, let us now turn our attention to the districts bordering on the coast, commencing with those situated between the Atlas and the sea. The northwestern portion, forming the empire of Morocco, or Marocco, is perhaps more favourable for the habitation of man than any other portion of the coast. The land extending from those mountains to the ocean is generally level, although approaching in character to that of table land. There is a great want of wood, but the soil and climate are admirably adapted for the growth of corn, although a considerable portion is now covered with unprofitable weeds. Maize, or Indian corn, is extensively cultivated; as is also dhoorah (here called Guinea-corn). The cork-tree, palmetto (fig. 172), date, almond, olive, walnut, and a great variety of fruit-trees, are met with; besides the rose, myrtle, cactus, aloe, &c.; whilst in the spring, the ground is enamelled like a carpet with the iris, crocus, daffodil, and narcissus, and adorned with the gay blossoms of lupines, African marigolds, &c., in full flower. The mountains of Atlas rise very abruptly from this plain, and are in some parts covered with pines of immense size; as also with cedar, mountain ash, fir, and juniper. The most elevated part of the Atlas range is situated in this territory; Miltzen attains the altitude of 11,400 feet above the sea; but other summits, yet unmeasured, are supposed to exceed that elevation.

Various branches diverge from the Atlas range, and enter the territory of Algiers, the ancient Numidia, giving it a

diversified character. These mountain ridges are intersected by valleys of great beauty and fertility, adorned with the most luxuriant groves of pomegranate, orange, and citron; the grapes and melons also arrive at great perfection, and the olive trees attain a remarkable size. To the eastward of Algiers, the Atlas range recedes further from the coast, leaving at its base the spacious and fertile plain, which forms the territory of Tunis, where anciently stood the famous city of Carthage. The most northerly point of Africa, Cape Bon, is situated in this district; and the whole coast from that spot to the Straits of Gibraltar is exceedingly bold and picturesque. The country to the eastward, however, presents a totally different aspect; the great mountain range of the Atlas, which, with its various subordinate branches, performs so prominent a part in diversifying the surface, and thus diffusing verdure and fertility over the western districts, here terminates; and although Tripoli and Barca contain some fertile tracts, in which barley and dhoorah are cultivated, a large portion of this territory consists of sandy and desert plains. Opposite to Tripoli lies the island of Zerbe, once inhabited by the Lotophagi, thus alluded to in the *Odyssey:*

> They eat, they drink, and Nature gives the feast;
> The trees around them all their food produce;
> Lotos the name, divine nectarious juice!
> Thence called Lotophagi.

So fascinated were some of Ulysses' companions by the fruit of the lotos, that they were compelled to be removed by force from the spot:

> The three we sent, from off th' enchanted ground
> We dragged reluctant, and by force we bound.

The lotos of Homer is supposed to have been the Ziziphus lotos, a tree or shrub met with in many parts of Northern Africa. It bears small farinaceous berries, of a yellow colour, described as of delicious taste. They are much esteemed by the natives, who dry them, and make them into cakes, said to resemble delicate gingerbread in flavour. A sort of wine is also prepared from them; and we cannot but suppose, that it

was the latter "divine nectarious juice," rather than the simple berries, that proved so fascinating to the companions of Ulysses.



[illegible]phus L[illegible]t[illegible]

Egypt, so interesting from the recollections, both sacred and classical, with which it is associated, consists of a spacious valley, bounded by mountains and deserts, owing its existence solely to the Nile, of which it has been emphatically termed "the gift." The traveller who visits this country in the dry season, beholds only a vast dreary plain, enclosed by whitish and bare mountains, and sprinkled with a few trees and withered shrubs. On the 18th or 19th of June, however, the waters of the Nile begin to rise, and continue to increase until September, at which time they attain their greatest height, and the country resembles an extensive lake; amid the waters of which appear occasional patches of date-trees, fig-trees, acacias, tamarisks, willows, &c. The waters subside as gradually as they rose, leaving behind them a rich deposit of

alluvial soil, in which spring up the most splendid and redundant harvests; no region on the earth, perhaps, exceeding this in fertility. In Upper Egypt the surface of the land is more mountainous, and the breadth of the valley less extensive. In Nubia this becomes still more contracted, the latter territory consisting of a narrow belt of land of great length, which, like Egypt, is rendered fertile by the Nile, and which is bounded on the west by the almost interminable deserts of the Sahrà; whilst to the south rises the mountainous country of Abyssinia, where range succeeds to range, presenting rocky heights of the boldest and most rugged character, amongst which rises the mighty stream which fertilizes this part of Eastern Africa.

The animals of Northern Africa include vast numbers of apes; lions of the largest and finest description, which are very numerous; leopards, hyænas, and jackalls; herds of elephants; and in the mountainous districts, bears and wild boars; whilst the hippopotamus and crocodile frequent the rivers. Ostriches are very numerous, and the sacred ibis of the Egyptians (fig. 130) still frequents the banks of the Nile, whilst the sandy tracts abound in bustards and quails. Among domesticated animals, the horses of Barbary are celebrated; and not less valuable is the camel, called also the heric, which not only bears the traveller across the desert tracts, but affords a supply of milk for his nourishment during the journey.

The vegetation of Northern Africa bears a great resemblance to that of Europe on the opposite shores of the Mediterranean Sea, though Egypt possesses some plants belonging to intertropical regions, the seeds having probably been carried down by the waters of the Nile, and deposited in the rich bed of alluvial soil they leave in their passage. The vegetation of the western districts of Northern Africa, having been already incidentally noticed in our review of those regions, we shall now direct our attention to that of the eastern parts, and more especially of Egypt.

The sandy plains present, generally, a surface totally destitute of vegetation; but in spots where springs occur, the tamarisk, acacia, mimosa, caper plant, &c., are met with;

whilst the more saline soils occasionally produce the salt worts, and the mesembryanthemums; the latter plants being especially adapted for thriving in arid situations, their peculiar organization enabling them to retain an abundant supply of moisture, even during the period of greatest drought. The declivities of some parts of the beautiful mountains of Abyssinia are covered with thick forests of tamarinds, and lofty wild citrons and orange trees; at a certain elevation these disappear, and are succeeded by gigantic cedars, which in their turn, gradually decrease in size, and become at last quite stunted and dwarfish. The most remarkable plants on these mountains, however, appear to be the aloes and cacti; the aloe is described as presenting a magnificent appearance, and the cactus as being of various species, and of the most diverse forms, growing like a wood, through which it is difficult to find a passage.

Among the plants of Egypt, one of the most remarkable is the papyrus (fig. 211), from the white pith of which the ancients prepared their paper. The sacred lotus of Egypt (fig. 2), which is a kind of water lily, is another remarkable plant; and the Egyptian arum (fig. 200) is extensively cultivated for its large esculent roots. The bean is supposed to be a native of Egypt, and the cerealia have at all periods abounded in that country. The onion (fig. 188) attains such peculiar excellence and fine flavour in this country, that among the ancient Egyptians it formed an object of worship; and the modern inhabitants of Egypt assign it a place in their paradise. This country is no less celebrated for the superiority of its melons and cucumbers, the latter especially, being considered not only to surpass those of other countries, but to be exceedingly wholesome. This excellence of the cucumbers, the melons, and the onions, of modern Egypt, cannot fail to strike us as highly interesting, from the remarkable instance it affords, of the correspondence of the vegetable productions for which that country is noted at the present time, with those for which it was celebrated in the most ancient historical periods; when, (as we read in the Book of Numbers,) the Israelites, during

their sojourn in the Wilderness, murmured, saying, "We remember the cucumbers, and the melons, the leeks, the onions, and the garlic."

Eastern Africa, extending from Abyssinia to Caffraria, is but little known. Barbur, which is situated immediately to the south of the Straits of Babool Mandeb, contains some lofty mountains, which approach within four miles of the sea, and are covered with pasturage. Camels are particularly abundant in this part, and form the principal food of the natives. This territory is considered to be the original habitation of frankincense, myrrh, and various other odoriferous gums.

Proceeding from Barbur, we first meet with a district of arid and sandy character; and further southwards we arrive at Sena, distinguished for the remarkable fertility of its soil. Natural advantages are, however, usually bestowed in vain, if neglected, or left unimproved by man; a very small amount of labour would secure exuberant crops; but the supine inhabitants of some districts in this territory, presuming upon this extreme fertility of their land, and preferring a life of indolence and ease, neglect its culture; the consequence of which is, that in those parts even famines are not unfrequent. Whilst considering this striking instance of apathy and indolence, we, who inhabit a country less favoured by nature, cannot but feel, that though in our land

> Niggard Earth her treasures hide,
> To all but labouring hands, denied,
> Lavish of thorns, and worthless weeds alone,—
> The boon was half in mercy given.

Continuing our southward course, we arrive at "Sofala, thought Ophir." This place formerly carried on an extensive trade in grain, and in gold and silver; but the introduction of the slave trade has transformed this seat of peace and agriculture, into a scene of war, bloodshed, and misery.

> Tell, if thou canst, the sum of sorrows there,
> Mark the fixed gaze, the wild and frenzied stare,
> The rack of thought, the freezings of despair.

The once flourishing Sofala, or Ophir, from whence, at its

first discovery by Europeans, as well as in the days of King Solomon, the finest gold was procured, now consists only of a paltry fort, and a few miserable mud huts.

Our knowledge of the vegetable productions of Eastern Africa is very limited. Besides the odoriferous gum-bearing plants, the most remarkable known, are the columbo plant (fig. 122), which grows spontaneously in the thick forests of Mozambique; and the Telfairia volubilis, which is a climbing plant, discovered within a few years on the coast of Zanzibar. The latter valuable plant, which is said to be easily cultivated in a suitable climate, produces an esculent fruit, three feet in length, and full of seeds, which are 264 in number, of the size of chesnuts, and described as equalling the almond in flavour, and also yielding an abundant supply of oil, not inferior to that of the olive.

In South-Eastern Africa ostriches are unknown; but lions, panthers, buffaloes, antelopes, and elephants are very numerous; and this region affords vast supplies of ivory.

The surface of Southern Africa has been in some measure described; its natural productions are of considerable interest. Abundant supplies of copper ore and iron have recently been discovered. The latter occurs near the Great Fish River, in a very remarkable form, masses of iron, of that peculiar composition considered by chemists to have a meteoric origin, being scatterred in abundance over a considerable tract of country; conveying the impression, that a shower of meteoric iron must have fallen in that locality*.

Large portions of this region are occupied by the karroos; other parts are covered with dense brushwood, consisting chiefly of low thorny bushes, which form the favourite haunts of the Boschismans or Bushmen. But other parts, again, pre-

* The fall of a meteorite which occurred on the 13th of October, 1838, at the distance of about a hundred miles from Cape Town, is remarkable, when considered in connection with the above account. This meteor is described as having equalled the moon in brilliancy and apparent size; and as having fallen without noise or explosion. The mass of meteoric matter is said not to have been less than four cubic feet in dimensions.

sent an assemblage of magnificent and valuable trees, as well as beautiful and singular flowering plants. Among the former, we find the chesnut, almond, and plum; superb fig trees, attaining the height of sixty feet; orange and lemon trees, mimosas, acacias, the black ebony, the willow, &c. An admirable fruit, about the size of a shaddock, already alluded to, is mentioned by Sir James Alexander as growing near Walvisch Bay, on which the inhabitants of the territory in that vicinity, subsist for three months in the year. The flora of this region includes a considerable number of the chief ornaments of our conservatories, as well as various species which rank among our "half-hardy" plants. Amidst these, the heaths (fig 123) stand pre-eminent, both in beauty and elegance of form, and in variety of species. Nor are they confined to a limited range of elevation: hill and plain are equally adorned with the different species, and our conservatories boast of at least five hundred species and varieties, all of which are derived from this region. The proteas are another numerous family, as are also the mesembryanthemums (fig. 24), and the pelargoniums. Here, too, occurs a peculiar group of euphorbias (fig. 52), which assume various singular and fantastic forms, and many of which rise to a considerable height. They all contain (like our little Euphorbia helioscopa, or wart-wort,) an acrid milky juice, which forms a powerful poison. The stapelia (fig. 137) is another remarkable genus of plants, with square, succulent, leafless stems, and flowers much resembling a star-fish, which, from their offensive odour, are called carrion flowers. The ixia (fig. 169) is another genus peculiar to this region; whilst the aloes (fig. 192) are very numerous, as are also the gnaphaliums and xeranthemums, and the terrestrial orchideæ. One of the most singular plants, however, is the Tamus elephantopus, or elephant's foot, called also Hottentot's bread (fig. 196). In this extraordinary plant, the bulb stands entirely out of ground, and grows to an enormous size, being frequently three feet in diameter. It contains a fleshy substance, like a turnip in consistence and colour, which is eaten by the Hottentots.

It has been already mentioned, that the fauna of Southern Africa is, in great measure, distinct from that of the northern regions of this division of the globe, if not in genera, at least in species. The quadrupeds of the region we are now considering, are both numerous and varied; and include the chacma, or pig-faced baboon (fig. 5), the lion (fig. 11), hyæna (fig. 21), proteles, or aard wolf (fig. 22), jackall, Cape ant-eater, or aard wark (fig. 63), elephant (fig. 66), white rhinoceros, two-horned rhinoceros (fig. 69), wild boar, zebra (fig. 79), quagga, southern giraffe (fig. 83); a great variety of antelopes, among which are the fleet and agile spring bok, the algazel (fig. 91), and the gnu (fig. 93); the Cape buffalo (fig. 96), &c.

The birds, also, are abundant, and flocks of vultures of various species are seen in the karroos, where the remains of numerous quadrupeds, killed either by beasts of prey or perishing in the course of nature, require to be removed. Eagles and falcons are also met with in considerable numbers; and the barn owl and great horned owl, which are supposed to be of the same species as those of Europe: whilst the secretary bird, or snake eater (fig. 117), which is peculiar to Southern Africa, roams over the sandy plains, carrying on a perpetual warfare with all kinds of reptiles. The Cape honeysucker, and Cape coly, are small birds of dull-coloured plumage, but rendered conspicuous by the length of their tails. The honey guide is a native of this region, and is held in high estimation by the Hottentots, to whom it forms a guide to the stores of the wild bees. This bird feeds chiefly on bees, and on their honey, and by a peculiarly wise provision, it is furnished with a remarkably thick skin, adapted to fortify it against the attacks of the insects whose treasures it invades. Perhaps, however, the most remarkable birds met with in this region, are the weaver birds. The beautiful scarlet weaver bird builds its nest among the reeds; this is composed of twigs, closely interwoven with cotton, and divided into two compartments. But the nest of the republican, or social weaver bird, is yet more curious. These birds live in vast societies, and their nests are united under one common roof. These remarkable

encampments, or villages, progressively increase in size, the birds being observed to add to the dimensions of their common dwelling, every season, until the trees, unable to support any additional weight, sometimes fall to the ground, and the birds are compelled to seek a new site for their habitation. These



Nests of the Social Weaver Bird

little towns are said to have numerous entrances, each of which forms a regular street, with rows of nests on each side, about two inches distant from each other; and a village or community sometimes contains eight hundred or a thousand.

The coast of Western Africa next claims our attention; the southern districts, however, appear generally unproductive. To the north of Walvisch Bay, the Quawas, or Claytrap Mountains, approach the shore; these mountains, about 2000 feet in height, form a conspicuous land-mark, known to mariners as the Blue Mountains. Some of the rocks in this part of Africa appear to be volcanic; and at a short distance to the northward of this district, a singular effect is produced by some rocks, which contain a considerable proportion of mica and quartz, and which are described as appearing quite



grove.—Rhiziphora Gymnoriza.

dazzling; one cliff in particular "reflecting the sun's rays like a mirror." To the northward of Espiegle Bay, the face of the country becomes more diversified; in some parts presenting ridges of park-like land, verdant hills, and luxuriant and beautiful valleys, often clothed to the water's edge with the richest verdure; though other parts are low and swampy, and present nothing but "mud and mangrove trees." The mangrove, although not useful as a timber tree, is, however, singularly adapted for the situation it occupies; and in various tropical countries, the different species of mangroves occupy the very borders of the streams, and other watery places, where no other trees will grow, and not only afford shelter to vast numbers of animated beings, but perform an important part in the economy of nature; gradually preparing the land by their decay, for the reception of other plants of greater utility to man.

Passing the lofty peak of Cameroon, and the mouth of the Quorra River, we arrive at the shores of Ashantee, usually called the Gold and Ivory Coasts, which are flat, and covered with thick forests. To this district succeeds the Grain Coast, so named from a species of pepper obtained from thence, which, before the introduction of the East Indian spices, was highly esteemed in Europe, and termed "grains of Paradise." It is produced by a small parasitical plant, the fruit of which contains aromatic seeds or grains. Between this and Cape Verde, the country is chiefly marked by the mouths of various rivers, which discharge their waters into the Atlantic, and the banks of which are generally finely wooded and fertile. Near Cape Verde, the most westerly point of Africa, the sandy soil bears a vast number of the gigantic baobab trees, which impart to this spot the verdant aspect from which it has obtained its name. The interior of the country is of a mountainous character, and abounds in gold. The River Senegal terminates the fertile tracts of Western Africa, and the Great Desert extends from thence to the borders of Marocco.

The vegetation of Western Africa includes some remarkable and valuable plants. Among these we find the majestic bombax,

or silk cotton tree (fig. 34); the baobab, or adansonia (fig. 35), one of the most valuable plants of this region, the fruit of which, called monkey bread, forms a principal article of food with the natives; the African earthnut (fig. 66), remarkable for maturing its fruit underground; after the blossom withers, the flower stalk bends downwards, and the pod is buried in the soil, where it perfectly ripens; the nut, or bean, is eaten, and likewise produces a valuable oil. Various other edible fruits are also met with, such as the African custard apple, the mammee apple, the African locust tree, the pods of which contain a farinaceous substance, used as food; the peach of the negroes (fig. 130), which is a large and fleshy fruit; various plums, tamarinds, &c., &c., and the shea, or butter tree, which abounds in a yellow greasy juice, which the natives mix with their food.



Leaf and Fruit of the Butter Tree.

Plantains, cocoa-nuts, pine-apples, and various other fruits, have been introduced, but are not considered to be indigenous to Africa. The same remark applies to rice and maize. The oil-palm (fig. 185), from which palm oil is obtained, and the pandanus candelabrum (fig. 198), are, however, natives of this soil, and very abundant in this region. The oil-palm, from its great value, has been termed "the natives' friend;" it supplies them with wine, oil, palm nuts, an excellent repast in the "cabbage," or young sprouts; besides materials for fishing tackle, hats, baskets, and various other purposes.

Separated, as is this region from Northern Africa, by the Great Desert, its animal productions are found generally to approach nearer to those of Southern than of Northern Africa. Its most characteristic feature, as far as its zoology is known, appears to be the preponderance of animals of the monkey tribe; among which we meet with the mona monkey (fig. 3), the red monkey, and the green monkey. Numerous large apes and baboons also occur, including the Chimpanzee (fig. 2), which appears to be known over a large portion of Western Africa. Antelopes are very abundant in this, as well as in other parts of Africa; and some species are more particularly so in this region: among these are the harnessed antelope, and ribbed antelope, which are very elegant and beautiful animals. The lamantin, manati, or sea-cow, frequents the mouth of the Senegal*.

The birds of Western Africa are very splendid, and include the beautifully coloured sun-birds, the golden orioles, the hoopoes, the rollers, adorned with the brightest tints of azure, purple, and green, and the beautiful bee-eaters. The only gallinaceous bird of any importance, is the Guinea fowl, which has long been domesticated in Europe. The insects are innumerable, and many of these form articles of food with the natives. Locusts (fig. 180) are exceedingly abundant; but the myriads of ants which swarm in tropical Africa almost exceed conception. They are of numerous species, but all

* This animal, which raises itself out of the water to suckle its young is supposed to have given rise to the fabulous accounts of mermaids.

possess similar destructive propensities; and, although they are serviceable in removing from the earth decayed animal and vegetable substances, which are no longer necessary or useful in the economy of nature, these creatures prove dreadfully annoying to man; destroying his food, furniture, books, clothes, and even the timber of his dwelling. The remarkable habits and extraordinary pyramidal nests of the termites, or white ants (fig. 181), render them objects of great interest to the student of nature.

Among the islands of Eastern Africa, Madagascar holds a prominent place. It is 960 miles in length, and has a width varying from 200 to 500 miles. Being thus surrounded by the sea, and also traversed by a ridge of high mountains, it enjoys, notwithstanding its warm latitude, a temperate and pleasant climate. Its natural productions are little known; but among the indigenous plants used as food, are the yam, arum, bread-fruit, and plantain. The sugar-cane is also a native of this island, and the cocoa-nut abounds on its shores. It contains many valuable timber trees, and various species producing ornamental woods; among the latter is the ebony (fig. 125). The dragon's blood tree (fig. 190), the banyan, and the famous tanghin poison tree, are also included among its natural productions. Turning to the animal kingdom, we find the fauna of this island differing considerably from that of Africa; the macauco, or lemur (fig. 6), here supplies the place of the apes and monkeys, which are not met with in Madagascar. The lion, horse, and elephant, are also unknown in this island; but wild swine, crocodiles, and serpents, are numerous; though it is said that none of the latter are venomous. Scorpions (fig. 170) and centipedes likewise abound; and fire-flies are met with in great numbers.

To the north of Madagascar is situated the small group of the Seychelles Islands, remarkable for producing a peculiar species of palm tree, the *lodoicea sechellarum* (fig. 184), which bears the double cocoa nut, called also *cocos de mer* (fig. 184). The lodoicea attains a height of eighty or ninety feet, and is surmounted by a beautiful crown of winged and palmated

leaves. The diameter of the stem varies from twelve to fifteen inches, and the whole is so flexible, that the tops of those trees which stand in each other's vicinity, strike and chafe against each other in a strong breeze, making an extraordinary noise. The leaves open like a fan; they are of large size, often attaining a length of twenty feet or more, with a breadth of ten or twelve. The fruit is generally double, but sometimes triple, or even quadruple, and with its enclosing drupe, attains a length of fifteen or twenty inches, with a circumference of three feet, sometimes weighing from forty to fifty pounds. The uses to which the lodoicea is applied are very numerous.

The natural productions of the islands of Mauritius and Bourbon, as may be expected in detached islands of not very large dimensions, are not numerous; the principal native mammiferous animals consisting of a few species of bats. The celebrated dodo, once an inhabitant of Mauritius, has apparently long been extinct. The marine shells are remarkable for their beauty and profusion; but, as well as most of the other productions of these islands, are similar to those of the Indian Archipelago.

The vegetation of the islands on the western side of Africa bears a general resemblance to that of the mainland. St. Helena, however, contains many species peculiar to itself, though none of particular general interest. The island of Ascension possesses a very scanty flora; containing few indigenous plants, except the tomata, nasturtium, chickweed, dandelion, forget-me-not, Cape gooseberry, and some ferns and mosses. It is remarkable for the abundance of turtles (fig. 140) which frequent its shores. The Cape Verde Islands are by no means fertile: the Canaries, however, are of totally different character.

These isles, in olden time named Fortunate,
For friendly skies there so propitious shine,
'Twas deemed Earth gave her fruits uncultivate,
And luscious grapes adorned th' untended vine*.

* Ed eran queste l'Isole felici, &c.
TASSO, *Gerusalemme Liberata*, Canto 15.

These beautiful islands possess a peculiarly fine and healthy climate, and, during the greater portion of the year, the luxuriance and beauty of their vegetable productions is almost beyond description; but the Canaries are subject to the visitation of locusts, as also to the destructive effects of floods in the rainy season, and, at intervals, of earthquakes and volcanic eruptions. The peak of Teneriffe has been divided by De Humboldt into five zones, termed the region of vines, the region of laurels, the region of firs, the region of the spartium, or broom, and the region of grasses. The first zone extends from the level of the sea to 1200 or 1800 feet. In this region, with the vines, grow the euphorbias, mesembryanthemums, and many other tropical and African species; whilst the dragon's blood tree here attains an astonishing size, and appears almost to compete with the baobab tree in longevity*. The second zone, that of the laurels, includes the splendid forest-trees which crown the hills adjoining the volcano; among which, we meet with an indigenous olive, a species of oak, of chesnut, &c. The region of firs commences at the elevation of 5400 feet, and terminates at about 7200. To this succeeds the region of the spartium; after which is that of grasses. Beyond the region of the grasses, some lichens cover the arid soil, and tend to effect the decomposition, and consequent preparation of the volcanic matter, for the growth of other plants. The productions for which these islands are most remarkable are the canary wine, and archil, or orchil (fig. 219), a species of cryptogamic plant, used in dyeing†.

Madeira unites the vegetation of Europe with that of Africa; but the euphorbias and mesembryanthemums, so characteristic of the latter region, are here wanting; and although the vine arrives at very great perfection, the other European fruits are said to be inferior in flavour even than in Britain. The Azores, or Western Isles, sometimes included among the

* See page 69.

† The beautiful purple or crimson tint obtained from this plant (called also argol) is usually employed for colouring the liquid in spirit thermometers.

islands of Europe, are very fertile, more especially St. Michael's, celebrated for its oranges.

The African volcanic region is neither so continuous, nor so strikingly energetic, as some of the volcanic regions we have considered. The mainland of Africa, (with the exception of the northern districts, which, as we have already remarked, may be regarded as included in the European volcanic region,) as far as at present known, indeed presents comparatively few indications of igneous action. Some volcanic rocks, have, however, been observed near Walvisch Bay, and also on the banks of the Nunez.

But the principal volcanic group known to exist on the mainland of Africa, occurs in the north-eastern districts. This volcanic formation appears to commence at Jebel Achmar, about three miles to the east of Kahiro, stretching from thence to Suez, and including in this part the craters of two extinct volcanos. From Suez the volcanic formation extends in a south-eastward direction, the whole of the western coast of the Red Sea presenting a soil of volcanic production, from Suez to the straits of Bab-el-mandeb. The little island in the straits is also volcanic, as are likewise the hills surrounding Aden. On the shores of Africa opposite to the latter place, again, the vast desert which forms the country of Adel, is an upheaved volcanic formation, traversed in all directions by ranges of hills of moderate elevation, bearing the impress of subterranean fire. There are a great number of extinct volcanos in Adel, and the quantity of lava met with is prodigious, being in some places 130 to 140 feet thick. Hot springs, varying in temperature, from 155° to the boiling point, are also very numerous in these districts; and at the distance of about fifty miles from Ankober, there is an active volcano, from which smoke perpetually issues. Nearly all the African islands are of volcanic origin, and many of them contain active volcanos, and also suffer from earthquakes.

The principal group on the eastern side of Africa, is that which includes Madagascar, and the islands of Mauritius and Bourbon. Madagascar contains an active volcano, to which the

appellation of Radama has been given, in honour of the late enlightened chief of that name. Mauritius is volcanic; and Bourbon consists entirely of a mass of volcanic matter, forming two mountains, one containing an active volcano, which, for a long period, has regularly emitted lava on alternate years. This island also presents many indications of violent convulsive movements*.

On the western side of Africa, the rather distant island of Tristan d'Acanhua (which rises abruptly from the sea, in the form of a truncated cone) consists of an extinct volcano. St. Helena is also wholly of volcanic formation, and subject to earthquakes. The island of Ascension is chiefly of similar composition, and vast beds of scoriæ and lava cover many parts of the island. Approaching nearer the mainland, we meet with the Isles de Los, which consist of a series of volcanic islands, some increasing, and others diminishing in size. Of similar formation are the islands in the Bight of Biafra, including Anna Bom and Prince's Island, the latter of which was so named from

> The Lusitanian Prince†, who, Heaven inspired,
> To love of useful glory roused mankind,
> And in unbounded commerce mixed the world.

Proceeding northwards, we find the Cape Verde Islands, not only of volcanic formation, but containing, besides many other indications of energetic igneous agency, an active volcano in the island of Fogo, which, from the ashes which fell on a vessel, appears to have been in eruption in February, 1839. The whole group of the Canaries is volcanic; and in some parts of these beautiful islands, splendid basaltic cliffs rise perpendicularly from the sea to the height of 1500 or 2000 feet, whilst the peak of Teneriffe attains the elevation of 12,236 feet. The crater at the summit of this cone has, since it has

* The volcanic island of Amsterdam is too far removed to be included in this group.

† Henry, third son of John the First, king of Portugal, whose enterprising spirit greatly conduced to the improvement of modern navigation. He flourished in the beginning of the fifteenth century.

been known to modern Europeans, ceased to emit lava, but is in the state of a solfatara*; and numerous eruptions have taken place from lateral openings in the mountain. And though no very recent eruptions appear to have occurred in the other islands, one of most terrific description took place in Lancerote, which commenced in 1730, and lasted for above five years. The island of Madeira consists of one mass of basalt, and has also frequently suffered severely from earthquakes. It may, however, be questioned, whether both this and the Canaries, ought not rather to be included in the European volcanic region; unless indeed we may consider them as links, uniting the African and European volcanic chains.

CHAPTER XIX.

THE NEW WORLD.—GENERAL FEATURES OF NORTH AMERICA.—NORTH AMERICAN ISLANDS.

> Say, who first passed the portals of the West,
> And the great secret of the deep possessed.
> Who first the standard of his faith unfurled
> On the dread confines of an unknown world.
> . . . . . . By Heaven designed
> To lift the veil that covered half mankind!—Rogers.

The form of the New World offers a strong contrast to that of the Old World, and instead of consisting of a vast extension from east to west, stretches from north to south, through 120 degrees of latitude. The principal range of mountains corresponds with the form of the continent, traversing it throughout its whole extent, and presenting by far the most continuous line of elevated land, on the surface of the globe; the length of

* A volcanic vent, from which sulphur, or sulphureous, watery, and acid vapours and gases, are emitted, but which does not emit lava, or other solid products, is termed a solfatara.

this mighty range, in some parts containing summits of stupendous elevation, being little less than nine thousand miles.

The continent of America may be divided into three grand portions, North America, South America, and Central America.

One of the most important and striking features of North America, consists of the vast range of mountains forming part of the grand central axis of the New World. These mountains were known to the early settlers as the Chippewayan Mountains; but from their broken and rugged character, and bare granite summits, they have received the name of the Rocky Mountains, or the Stony Mountains. This range runs parallel to the shores of the Pacific, from the Isthmus of Panama to the borders of the Arctic Ocean, where it terminates at no great distance from the mouth of Mackenzie's River. Many of the summits attain a considerable elevation, ranging from 12,000 to 15,000 feet. The altitude of these mountains does not, however, appear to have been very correctly determined; and it has even been stated, that the elevation of one peak approaches to 25,000 feet above the level of the sea, and that others, little inferior in height, occur in the same vicinity. This, however, perhaps requires confirmation. The Rocky Mountains, especially in their northern prolongation, are divided into several parallel ranges: and in one part, no less than thirteen successive ridges are said to occur. These ridges are in some places intersected by elevated table-lands, and in others by deep and well-watered valleys; but the peaks of the mountains are generally bleak and bare; and in their higher parts they are covered with perpetual snow. These snow-capped summits present a brilliant appearance, from whence these mountains obtained, among some of the first observers, the appellation of the Shining Mountains.

The other principal mountain ranges of North America, also take a general direction from north to south. Between the Rocky Mountains and the Pacific, a mountain range, in some parts connected with the central line, with which it runs nearly parallel, extends from the northern parts of the continent to

the peninsula of Lower California, where it bears the name of the Californian Maritime Alps. The River Colombia which takes its rise among the rugged summits of the Rocky Mountains, crosses this secondary range, where it forms some grand cataracts, and having passed between the lofty summits of Mount Hood and Mount St. Helens, pours its waters into the Pacific, after a course of a thousand miles.

In the eastern parts of North America, the Alleghany or Apalachian Mountains also extend in a northerly and southerly direction, stretching from Alabama and the northern confines of Georgia, nearly to the banks of the St. Lawrence. These mountains are by no means so elevated as those of Western North America, the highest summits not much exceeding 6000 feet and the general elevation of the Alleghanies ranges from 2000 to 3000 feet above the level of the sea.

The Lowlands of America form another striking feature in its natural geography. These extensive levels generally possess a sandy soil, and in some parts bear much resemblance to the steppes of Asia. They are naturally divided into three portions; namely, the Western Lowland, or the plains between the Rocky Mountains and the Pacific; the Central Lowland, comprising the vast plains through which the Mississippi flows; and the Eastern Lowland, consisting of the comparatively narrow plains lying between the Alleghanies and the Atlantic.

The north-western portion of the Western Lowland has been but little explored; as far, however, as it is known, it appears to contain vast plains, which are nearly destitute of trees; widely differing in that respect from this region in lower latitudes, where, however, it assumes a less level character, and where a great extent of country is covered by vast forests of most magnificent fir trees, including the valuable and gigantic Douglas pine*, the trunks of which vary in diameter from two to ten feet, and in height from 100 to 180 feet. Upper Cali-

* This important species, which has only been known within a recent period, having been discovered by Mr. Douglas, appears likely to be successfully introduced into this country, the climate of which seems to suit it perfectly. Its growth is very rapid

fornia possesses both a delightful climate and a fertile soil, but between that territory and the Rocky Mountains, a great sand plain occurs, 700 miles in length, and varying in width from 100 to 200 miles. The peninsula of Lower California possesses generally an arid soil, and the land capable of cultivation is very limited in extent; but it is noted for enjoying the most beautifully clear sky in the world.

The whole of North Western America possesses a milder climate than the central or eastern districts of the same continent, the winters being less severe, and the summers more temperate, than in the latter districts; a particular instance of which has been already mentioned, in speaking of the mean temperature of Sitka. This difference of climate considerably affects the character of the vegetation in these different regions; and even in genera, the flora of Western America differs much from the central and eastern districts, approaching nearer to that of Siberia. This subject, however, has hitherto been very imperfectly investigated.

We have already alluded to the magnificent forests of the Douglas pine, which, as well as some other species of the same genus (of even larger dimensions, though of inferior value), may be considered as the leading feature in the vegetation of this region. Here also we meet with the broad-leaved maple (fig. 32), probably the finest of its genus, which yields a timber scarcely inferior in grain to the finest satin wood. The red and white cedar, the oak, ash, and willow, occur in various parts, and some walnut trees. Wild cherries, sloes, erviceberries, gooseberries, currants, raspberries, strawberries, blackberries, whortleberries, and cranberries (fig. 124) abound in the more northern districts. To this region we are indebted for many recently introduced ornaments of our flower gardens; among which are the Ribes sanguineum, and various species of perennial lupine, clarkia, œnothera, escholtzia, &c. In the more southern districts, the vegetation bears much resemblance to that of Mexico, and California produces a splendid species of cactus, rising as a distinct and fluted column to the height of twelve or fifteen feet.

Among the animals of Western North America, we meet with the lynx (fig. 20), fox, wolf, black bear, grizzly bear (fig. 28); wolverine, or glutton (fig. 31); fisher; pine marten (fig. 37); beaver (fig. 49), (in considerable numbers); moose deer fig. 85); carabou, or American rein-deer, and some other species of deer; the cabree or American antelope; Rocky mountain sheep (fig. 103); and Rocky mountain goat, remarkable for its long white hair, of a silky texture, finer than that of the shawl goat of Thibet. Among the known birds one of the most distinguished is the Californian vulture, which measures four feet, or four feet and a half, in length.

The second great American Lowland, which is situated on the eastern side of the Rocky Mountains, and which forms the central basin of the continent, occupies much the largest portion of the whole surface of North America. In breadth it extends from the Alleghanies tothe Rocky Mountains, and in length from the Gulf of Mexico to the Arctic Sea and Hudson's Bay, widening considerably in its northern portion. Over the whole of this great area no mountain ranges occur, nor any elevations beyond a few long ridges of hills. This plain consists of three vastly wide and regular slopes, determined by the course of the Mississippi. The first, which extends from the Alleghanies to that river, is in some degree diversified by hills, and embraces the most fertile territory of the United States. The second slope, which is more extensive and also more uniform, rises gradually from tho Mississippi to the Rocky Mountains. A very considerable portion of this slope consists of sandy and bare prairies, whose surface, though gently undulated, "presents as few landmarks to guide the traveller on his way, as he would meet with in the middle of the ocean." A zone of about 200 miles in breadth is, however, well wooded; and in the more southern districts, the remarkable series of forests, known under the name of the Cross Timber, occurs. The latter belt of timber extends in a direct line from north to south, across the apparently interminable prairies of Northern Texas and the Ozark territory, to the southern bank of the Arkansas river. It varies in width from five to fifty miles; and in some parts

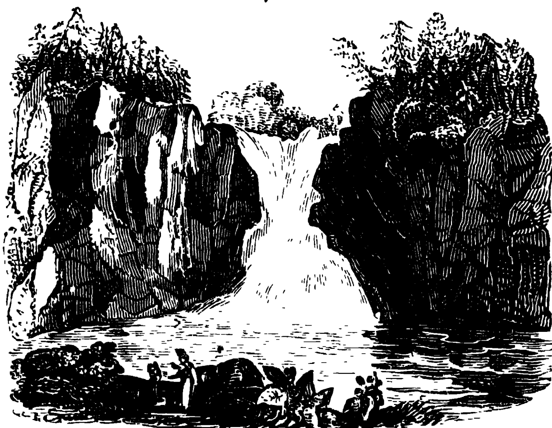
is so straight and regular, that it appears like a work of art, and when viewed from the adjoining prairies on the east or west, has the appearence of an immense wall of woods, extending from north to south in a straight line, the extremities of which are lost in the horizon. This remarkable belt "forms the great landmark of the western prairies; and the Indians and hunters," observes Mr. Kennedy, "when describing their routes across the country, refer to the Cross Timber, as the navigators of Europe refer to the meridian of Greenwich." The whole district lying on the Gulf of Mexico is low and swampy; and the coast of the Atlantic maintains a very similar character. The third slope extends northwards, from the sources of the Mississippi and the great Canadian lakes, to the Arctic Ocean and Hudson's Bay. The interior prairies of this region are, in their northern parts, destitute of trees, from whence they have acquired the name of the "barren grounds;" the southern districts, however, are well wooded, but the country bordering on Hudson's Bay is flat and swampy. The whole of this territory presents few elevated tracts, with the exception of a ridge which passes near the Great Slave Lake and Artillery Lake, and which appears to attain its greatest height near Sussex Lake, where it is supposed to be about 2000 feet above the sea. This ridge forms the water-shed, dividing the rivers which flow to the north and south.

To the eastward lie the territories of Upper and Lower Canada, Labrador, and Rupert's Land, which may be considered as a continuation of the Northern Lowlands of America; for, though some ranges of hills cross Canada, none occur of great elevation, and the surface of this extensive region is not much varied. Upper Canada, extending along the borders of the great lakes, is finely watered, and covered with immense forests of valuable timber. Lower Canada presents some very picturesque scenes, and notwithstanding its severe winters, nearly all the grains, and many of the fruits grown in Britain, come to perfection; whilst, owing to the higher summer temperature, maize is capable of cultivation. The pastures of Canada are fine; though the favourite green crop is the *squash*, or gourd,

with which the cattle are fed. Nova Scotia and New Brunswick are well wooded countries, many parts still consisting of unbroken magnificent forests. The winters, owing to the more insular situation of these lands, are less severe than in Canada, but fogs prevail through the greater part of the year, rendering the summers less warm. Labrador has all the charateristics of an arctic territory, being covered with forests of birch, pine, and fir, and filled with small frozen lakes. The climate of the large island of Newfoundland, compared with that of Britain, affords a striking illustration of the difference of temperature experienced in Western Europe, and in Eastern America. The soil of Newfoundland is rich, but the climate so unpropitious, that corn will not ripen, and only serves for green food. Potatoes, however, and the hardy European vegetables, succeed, but, instead of noble forests, stunted trees and low shrubs alone are met with; and at a certain depth beneath the surface, ice is found at all seasons of the year; and yet, the greater portion of this island is situated in a more southern latitude than any part of Britain.

The third lowland of North America consists of the strip of country lying between the Alleghanies and the Atlantic, and extends from the eastern coast of Massachusetts to the Gulf of Mexico, losing itself at its south-western termination in the plain of the Mississippi. This tract, which in the New England States is very narrow, comprising the mere coast and islands, expands in its course southwards; the mountains in South Carolina being more than two hundred miles from the sea. It may be considered as forming two distinct portions, being divided nearly through its whole length by a well-marked geographical, as well as geological boundary, consisting of a range of primary stratified rocks, which appear like a long line of cliffs, rising above the low, flat, and sandy plain, which extends from thence to the Atlantic; giving the idea that the waves of that ocean must at some former geological period have laved the base of this ridge. Below this rocky boundary, the aspect of the region is flat and monotonous, the general average elevation of the plain probably not exceeding 100 feet;

and its average width through the Middle and Southern States being from 100 to 150 miles. The line of this dividing ledge is marked out by the rapids and cataracts (among which is the Fall of the Passaic), in nearly all the rivers between New York and the Mississippi, their waters precipitating themselves over



Fall of the Passaic, at Patterson.

these rocks, which, in a considerable extent of country, form the limit of the rising of the tide; whilst the advantages presented by the "water power," has caused this boundary to be selected for the site of numerous cities and towns, such as Baltimore, Wilmington, Philadelphia, Patterson, &c. The upper tract possesses a very variable width, ascending with an undulating hilly surface, to a mean elevation of about 500 or 600 feet above the level of the sea, and swelling into bolder forms as it approaches the foot of the Blue ridge, or first range of the Alleghanies. This fine tract includes some very rich and fertile valleys.

North America contains many valuable mineral deposits. Coal occurs in great abundance in various parts of British

America, as well as in the United States; a coal-field, 1500 miles in length and 600 in breadth, being situated between the Alleghanies and the Mississippi. Salt springs are numerous in several parts of the United States; sometimes flowing naturally, as in the Arkansas territory, where the ground is covered with an efflorescence of salt. Some of these salt springs occur in marshy situations; and from having been the resort of deer, and other wild animals, to *lick* the earth impregnated with salt, they have been called *salt-licks*. Gold occurs in North Carolina; and silver in small quantities, in some parts of the United States. Copper has been found both in British America and in the United States. Lead also occurs in great abundance in the latter territory, and in some other parts of America. The more universal and valuable mineral, iron, is diffused over many parts of this continent; and a remarkable mass of meteoric iron, weighing 3000 lbs., has been met with in Louisiana. Beryl, garnet, sapphire, tourmaline, amethyst, &c., occur in some parts both of British America and the United States.

The vegetable productions of the western lowland of North America have been in some measure described. The whole region to the eastward of the Rocky Mountains, may be considered under one head. One of the most important features of this region consists of the vast forests, which once covered so large a portion of its surface, though now fast falling under the axe of the settler. Among these, oaks are very numerous, and their range extends from Canada to the extreme southern parts of the United States, varying, however, in height, from two feet to trees of the most stately dimensions. The scarlet oak, whose foliage changes in autumn to "scarlet honours bright," adds much to the beauty of the scenery at that season; whilst the tulip tree (fig. 5), another ornament of this region, and which attains the height of eighty feet, assumes a garb of the brightest yellow. The white elm ranks among the most graceful and majestic of American forest trees; and the elegant American locust tree (fig. 67), commonly known with us as the acacia tree, though in this country of little value, grows to a splendid

size, and forms an important timber tree in its native soil. Here also we meet with the ash, and various species of maple, including the sugar maple (fig. 30), from the abundant saccharine sap of which no less than nine million pounds of valuable sugar are said to be annually made in the northern part of the United States. Walnut trees are very abundant in this region and among these are the Illinois nut (fig. 102), much prized for its delicious kernel, the black walnut (fig. 103), and the hiccory (fig. 104). The Hudson's Bay poplar (fig. 110), American plane (fig. 114), and arbor vitæ (fig. 159), are also natives of this region. The fir tribe are likewise very numerous and varied, and include the swamp pine (fig. 146), gray or scrub pine (fig. 147), black spruce (fig. 150), Canada balsam fir (fig. 151), hemlock spruce (fig. 152), and the important Weymouth pine, (the white pine of commerce,) which, from its size, straightness of growth, and numerous valuable qualities, is particularly adapted for masts of ships, as well as many other purposes.

Rhododendrons, azaleas, kalmias, and more especially magnolias in the form of trees, abound in the more southern parts of North America, extending their range to about latitude 35°. From thence to about latitude 50°, this region is remarkable for the preponderance of asters and solidagos; whilst in the more northern parts, the saxifrages abound. Among the latter, is the *Saxifraga flagillaris*, the long runners of which, radiating from a central stem, give it a curious and spider-like appearance, from whence it has obtained among our sailors the name of the spider plant.

In these high latitudes the oak disappears; but the banks of the rivers are in some parts fringed with fir trees and willows, and the latter appears among the last trees on the islands of the northern lakes. The wild rose is also conspicuous on all the streams; and whortleberries, cranberries, &c., are in great abundance. The more northerly regions produce a species of lichen, to which the name *tripe de roche* has been given. This lichen is extensively used by the Canadian hunters as an article of food, and formed the sole means of sustenance for many days of



Weymouth Pine —Pinus Strobus.

Sir John Franklin and Dr. Richardson, and also some of their companions, during their expedition to these inhospitable



Tripe de Roche.

regions. Wretched as this diet may appear, the value of the plant must be regarded as great, in a climate where other alimentary vegetables are unknown; and it is a circumstance which cannot fail to excite our admiration of the providing care of the wise and beneficent Author of Nature, that the various species of lichen and other cryptogamic plants, which are capable of thriving in cold climates, are more adapted to afford nourishment to man than those of similar genera, growing in countries where the more nutritive vegetables abound. Various species of fungi also, which are highly noxious, if not absolutely poisonous, when met with in temperate regions, appear to lose their pernicious qualities in cold climates, where they are even eagerly sought for as articles of food.

Among the cultivated vegetables, oats and rye are grown in the northern parts of the agricultural districts; wheat and maize (fig. 203) in the southern parts, of which the latter appears to be a native. Vast quantities of rice are grown in the moist districts of the same region. The introduction of the latter valuable grain into Carolina appears to have been wholly accidental: a ship, on its return from the East Indies, was cast away on these shores, and some bags of rice being found among its stores, a trial was made of sowing it; when it succeeded beyond all expectation, producing a grain more esteemed for many culinary purposes, than that grown in its native regions. The cotton plant (fig. 37), also a native of the East, is likewise

extensively cultivated in the Carolinas, and Georgia; and the cotton produced on the coast in this region, and called "Sea Islands cotton," is considered some of the finest in the world. Tobacco (fig. 136) is raised in greater quantities in Maryland and Virginia than in any other part of the globe; whilst in the warm districts of Florida and Louisiana, the sugar-cane (fig. 201) is successfully cultivated.

We have before remarked, that the zoology of the New World is distinct from that of the Old, with the exception, however, of the Arctic regions, where similar species occur in both continents; among which we enumerated the polar bear, arctic fox, wolverine, &c., and some species of birds. The fauna of the lands bordering on the Arctic regions in America, is found to bear a general resemblance to that of the Old World, in similar parallels; but though the genera agree, the species are mostly different. Among the larger animals in this part of America, are the black bear, grizzly bear, barren-ground bear, wolf, bison (fig. 97), musk ox (fig. 98), moose deer, wapiti deer (fig. 86), American rein deer, and prong-horned antelope. The lesser animals, which comprise the greater number of the fur-bearing animals, include the fox, otter, racoon, badger, ermine, wolverine, beaver, &c., besides various species of marmots and squirrels, among which is the gray squirrel (fig. 52), which is particularly abundant in Carolina and Pennsylvania. The radiated mole (fig. 10), and the Virginian opossum (fig. 48), inhabit the more southern districts, the latter extending its range westward to California.

The short duration of summer within the Arctic circle,—the temperature being already on the decline, before the country is even partially cleared of its snowy mantle,—might lead us to suppose that no granivorous (or grain-eating) birds, could find a supply of food in such high latitudes. But, by an admirable provision of the beneficent Creator, the very peculiarity of this very severe climate tends to furnish the snow buntings and finches with food, at a season when the patches of ground cleared from snow, are scarcely larger than will suffice for the reception of their eggs. This is effected by the suddenness

with which the frost sets in; owing to which the process of vegetation is at once totally arrested: and the grass culms, instead of dying off and withering, as they do in more temperate latitudes, are preserved full of sap until the spring, the seeds at the same time remaining firmly fixed in their receptacles, until that period. As soon, however, as the ground is prepared by the melting of the snow for the reception of these seeds, they are cast to the earth, and in a few days a brilliant, though short lived, verdure gladdens the eye. These grass seeds and various berries, such as those of the cranberry, &c., form the food of the finches and other birds on their first arrival; and no sooner does the snow begin to thaw, forming a surface on the ice of the smaller lakes, than the larvæ of gnats, and other insects, swarm in myriads, affording abundant supplies of suitable food for the young birds, as soon as they are hatched. Other birds such as the ptarmigan, feed on the catkins of the dwarf birch and willow, and may therefore obtain their food, even amidst the snow. These and other capabilities, cause a large number of birds to migrate to these northerly regions, yielding, in their turn, a supply of food to the human inhabitants of those barren and desolate lands.

The passenger pigeons, whose migrations in such immense bodies, as actually to obscure the light of day, render them an object of interest, feed chiefly on beech masts, and their migrations appear, in great measure, dependent on the abundance of that food. They migrate northwards toward the end of summer, as far as the 62nd parallel; and return southwards when the supplies fail them in those parts. Among the other birds of North America, are the Virginian owl (fig. 118), the mocking bird, and innumerable flocks of warblers, fly-catchers, starlings, thrushes, woodpeckers, &c., keeping the noxious insects within due bounds, and making the woods resound with their notes. The turkey (fig. 124) is a native of these regions, and still found wild in the woods.

The islands of North America are, from their high latitude, subject to great severity of climate, and their animal and vegetable productions are limited in number. Southampton

Island, situated at the entrance of Hudson's Bay, presents a dreary appearance; the land being high and irregular, and the whole face of the country consisting of little else than rounded blocks of granite: the only trees are a few miserably stunted willows; and the only animals observed by Captain Back, were a brace of ptarmigans. The Georgian Islands possess an equally rigorous climate. Melville Island, the most westerly of the group, appears to be nearly destitute of animal and vegetable productions. Sir Edward Parry, during his stay in this region, met with no other animals than a few ptarmigans in the summer, and a pack of hungry wolves in the winter. A succession of islands, included in the same group, extends eastward from Melville Island, all bearing a similar Arctic character.

The remarkable substance to which the appellation of "red snow" has been given, occurs abundantly in the islands of North America. This substance, until very lately, was considered to be a cryptogamic plant; but recent investigations have led to the conclusion that it belongs to the animal, instead of the vegetable kingdom; and that it consists of an accumulation of the ova of a minute animal. In such vast quantities does this substance occur in these high northern latitudes, that in some parts, the snow has been found tinged with it to the depth of twelve feet, and the surface covered with it for several miles.

Greenland, although its actual limits have not hitherto been ascertained, is evidently a territory of vast extent. Its aspect is very dreary, especially on the eastern coast, which is described as consisting, in most parts, of one almost uninterrupted glacier, varied only by a few patches of vegetation, principally occurring on the banks of the rivers, which, in their course to the ocean, dissolve the ice in their immediate vicinity. A mountain range skirts the shores in this part, forming bold and precipitous cliffs, and rising in the interior into numberless peaks and cones, ranging from 2000 to 3000 feet in height; but the portion of the range known as the Werner Mountains, attains the elevation of 6000 feet above the

sea. These shores are deeply indented by bays and inlets. The south-western coast of Greenland, though apparently the most favoured portion of this arctic region, presents little to adapt it for the abode of civilized man. In this district, the only trees, if trees they can be called, consist of some low bushes of birch and willow, which never exceed two feet in height. A fine grass springs up in some parts, but withers quickly, when exposed to the warmth of the sun. Besides these plants, the vegetation chiefly consists of some species of cochlearia, sorrel, and a few other similar plants; one or two alpine flowers, and the ling, or common heath. It is a remarkable fact, that whilst not a single species of heath occurs in any part of America, the latter plant, so common in Europe, should also be met with in Greenland. The insects of Greenland, as we have already remarked, are likewise similar to those of the Old World. The larger animals consist only of the most northern species; and the seas abound in marine mammalia, which form the principal food of the natives.

CHAPTER XX.

GENERAL FEATURES OF SOUTH AMERICA.—THE ANTARCTIC REGIONS.

Where the roots of the Andes
  Strike deep in the earth,
As their summits to heaven
  Shoot soaringly forth.—BYRON.

Two remarkable features characterize the vast peninsula of South America:—the colossal range of mountains, which traverse it from north to south; and the almost boundless plains, which occupy so large a portion of its eastern surface.

The Andes, called also the *Cordilleras*, or *Chains* of the Andes, present a mighty unbroken range of elevated summits, rising, like a vast wall, on the western side of the continent,

parallel to, and at no great distance from, the Pacific Ocean, and extending from the dreary regions of Tierra del Fuego, to the most northern boundaries of South America: being also remarkable for the numerous active volcanos, and the prodigious volcanic agency exhibited in nearly their whole course.

Tierra del Fuego consists of a group of islands of mountainous character, intersected by narrow and deep arms of the sea. The summits of these islands are crowned with perpetual snow; but their steep and rocky shores are in great part covered with evergreen woods, consisting chiefly of a species of evergreen beech, and of the winter's bark (fig. 6), both of which thrive in the sheltered parts of these islands, as far as 2000 feet above the sea level. The line of perpetual snow descends considerably lower in this region, than in parallel northern latitudes; and yet, vegetation appears to thrive so luxuriantly, that on these shores, the fuschia and veronica, which in our climate rank as tender plants, not only flourish in the open air, but attain the size of woody-stemmed trees, the stems being five or six inches in diameter: and they were observed by Captain King, in full flower, at the temperature of 36°, and growing at the base of a mountain, two-thirds of which was covered with snow. This circumstance has been attributed to the superior clearness of the atmosphere in this region. The parrot and humming bird extend their range to the Straits of Magelhaen; the former in quest of the seeds of the winter's bark, whilst the humming bird sips the honey from the blossoms of the fuschia, and has even been observed fluttering about in the midst of a snow shower.

In their more southern parts, the Andes are not remarkable for their altitude; the average height being about 3000 feet, and the most elevated summit that has been measured to the south of the island of Chiloe, not exceeding 9000 feet above the sea. In this part which may be distinguished as Western Patagonia, the mountains border closely on the ocean, the waters reaching to their very base, and forming numerous inlets, resembling, though on a larger scale, the fiords of Norway; and the whole of the region off this coast presents

the appearance of the upper portion of a mountain range, the base of which is immersed in the ocean, whilst its summits form multitudes of islands. These islands are barren to seaward, but towards the mainland they are clothed with impenetrable woods; and there are very few acres capable of cultivation in the whole district: no place fit for the permanent abode of civilized man. The large island of Chiloe is fertile, but like this portion of the coast, exposed, as we have already seen, to an excessive amount of wind and rain.

In the territory of Chili, the Andes do not border so closely on the ocean, between which and their base, a belt of land occurs, varying in fertility, and becoming gradually less productive as it approaches the equator. Thus, the country in the vicinity of Concepcion, is covered with the richest and most luxuriant foliage; near Valparaiso, the hills are thinly clad with stunted brushwood, and a sprinkling of grass, the ground generally looking poor and bare; near Coquimbo the brushwood disappears, and nothing is met with but the cactus, and a few blades of gray or purple wiry grass, excepting indeed, during the rainy season, when beautiful annuals spring up: further northwards, all traces of vegetation cease, and sand hills and plains alone are seen, unless perhaps, in a few spots, where some stream of water, caused by the melting of the snow on the Andes, may fertilize the channel through which it takes its course.

The Andes, in this part, occasionally rise abruptly from the plains, with nearly perpendicular walls of sienite, 1000 feet in height. In those parts where the acclivities are less steep, the lower portion of the range is covered with lofty forest trees, which gradually diminish in size at increasing elevations, until they wholly disappear, and nothing but bare rocky masses are seen, or summits covered with perpetual snow. In the more northern parts of Chili, however, the mountains rarely reach the line of perpetual snow; this difference is not, however, attributable to their inferior elevation in those districts, but to their greater proximity to the equator, and the consequent greater elevation of the snow line.

The mineral productions of Chili are valuable and abundant. Gold, silver, and copper, are met with in various parts; and a vast deposit of excellent coal has been discovered near Concepcion. Rock salt is also abundant.

The southern districts of Chili are prolific in timber trees. The noble araucaria, or Chili pine (fig. 158), is almost exclusively confined to the territory still occupied by the yet unconquered tribe of the Araucarians. The myrtle grows to a large size in Southern Chili, producing useful timber. In the more northern and less productive parts, large trees occur only n the quebradas, or ravines; and the numerous cacti (figs. 21, 23) constitute the principal vegetation. This region may be considered as the native country of that valuable, and now widely diffused plant, the potatoe (fig. 135), which is very commonly found growing wild near Valparaiso, inhabiting steep rocky places on the cliffs near the sea, and always bearing pure white blossoms, free from the purple hue, so frequent in the cultivated varieties.

The wild animals of Chili, and indeed, of the whole narrow belt of land situated between the Andes and the Pacific, are not numerous. The most remarkable quadrupeds are the different species of llama, which inhabit the slopes of the mountains, and the chinchilla (fig. 51), which may be considered as supplying the place of the rabbit, and which occupies the higher parts of the mountain range. Among the birds, we meet with the condor (fig. 114), one of the largest of terrestrial birds, peculiar to the Andes, where it selects the highest eminences below the line of perpetual snow. Another remarkable bird, inhabiting Chili, is the plant cutter, whose bill is toothed like a saw, and employed in a manner similar to that instrument, for cutting off small branches of trees, thus enabling the bird to obtain the tender green leaves on which it feeds. A large species of humming bird, nearly four times the size of any previous known, has been observed in Chili, and has been named the Patagonian, or giant humming bird.

The grand central range of the Andes, which, from the southern extremity of the continent to the borders of Bolivia,

has formed one undivided ridge, separates near Potosi into two mighty parallel ranges, called the Eastern, or Bolivian Cordillera, and the Cordillera of the Coast. The Eastern, or Bolivian Cordillera, which may be considered as the more marked continuation of the grand range, does not, in its first portion, attain any very remarkable elevation; the average height of the summits being about 16,000 feet above the sea level. It consists of a metalliferous group, to which the celebrated mountain of Potosi belongs. In its northward prolongation, however, we meet with the most elevated summits in the whole range of the Andes. In this part, the gigantic Illimani rises abruptly to the height of 24,300 feet, far above the line of perpetual snow, which, in this parallel of latitude, reaches the height of about 17,000 feet. The colossal Illimani is succeeded by an almost continuous line of *nevadas*, or snow-capped summits, the most elevated of which is the Nevada de Sorata, 25,250 feet above the sea, the highest known mountain in the New World.

The Western Cordillera, or Cordillera of the Coast, is also of considerable, though not of equal elevation. Its highest summits all consist either of active volcanos, or of mountains of igneous origin. Many of their summits rise above the line of perpetual snow; and among these are the active volcano of Gualatieri, and the colossal dome-shaped Chuquibamba, which bears the appearance of having been formed of one simultaneously uplifted gigantic mass of trachyte, that has apparently pierced through, and rests upon, a stratum of red sandstone.

These vast ranges, which again unite in the Andes of Valcanata and Cusco, enclose the high table-land or valley of Desaguerado, and the elevated lake of Puno, or Titicaca. This lake is studded with numerous islands, from the largest of which the lake obtains its name*.

The Andes, so colossal in this portion of the continent, at this point also send forth, on their eastern side, numerous lateral branches of vast magnitude, among which one of the

* This island contains many Peruvian ruins, and the whole locality is considered to have been the earliest scene of Peruvian civilization.

most conspicuous, is that on which the city of Cochabamba is situated, and which includes several snow-capped summits. These lateral branches, and their collateral spurs, give a moun tainous and hilly character to this portion of Bolivia, where numerous beautiful valleys occur, possessing a delightful climate and highly fertile soil.

Western Bolivia, or the tract lying between this portion of the Andes and the Pacific, is almost destitute of vegetation. In some parts, the cactus is the only plant that succeeds; whilst in others, no plant, no bird, no insect whatever is seen.

The group of Cusco, which forms the continuation of the central line in Peru Proper, is not remarkable for its elevation. The mountains of Pasco contain some snow-clad summits, and enclose a valley or basin, 11,000 feet above the sea. The Andes, to the north of Pasco, divide into three parallel ridges, the most westerly of which alone contains any peaks rising beyond the limits of perpetual snow; and from this point to Chimborazo, a distance of 400 miles, no summits occur attaining that elevation.

The mineral treasures of Peru, with which those of the Bolivian Andes may be included, have long been celebrated. Tin and lead mines occur, as also, considerable deposits of copper, and beds of ironstone; but the most remarkable are the vast stores of gold, silver, and cinnabar (the common ore of mercury). The most noted mines are those of Lauricocha, or Pasco, in Peru Proper, and those of Potosi, in the Bolivian Andes, both of which are situated at great elevations. The silver mountain of Potosi, which is 16,000 feet above the sea, has no equal in the world. This vast deposit is eighteen miles in circumference, and forms one entire mass of ore, displaying on its surface all the varied metallic tints, of green, orange, yellow, gray, and rose colour. It was discovered in 1546, and from that period to the present time, the amount of silver extracted is almost incredible, and yet the supply still appears inexhaustible*.

* The sacrifice of human life in the prosecution of the search for these treasures, has been excessive. it is said that no less than sixteen extensive provinces have been depopulated in this cause.

The whole western coast of Peru, like the northern part of Chili, is a complete desert, intersected only occasionally by a distant quebrada, in which vegetation is, however remarkably luxuriant. Rain is unknown in Peru; but the climate, temperated as it is by the sea-breezes, is described as very delightful, especially in the narrow valleys, where almost every species of grain comes to perfection; the climate permitting both planting and reaping on every day in the year. The transition from the sterility of the desert regions to these fertile quebradas, or valleys, is very striking. The trees, however, even in these spots, are not numerous, and consist chiefly of willows, and a species of acacia. The zoology of Peru is little known: the llama (fig. 82) inhabits the Andes, and this animal is here trained to carry burdens. A species of tapir, totally different from that met with in the plains, also frequents these mountains; the body of this animal is entirely covered with long hair of blackish brown colour, it being thus adapted to inhabit the cold regions which form its station*. Peru contains a very small number of birds, and no noxious reptiles.

The Colombian Andes commence with the group of Loxa, where the three parallel ridges again unite. This district is the native region of the most esteemed species of quinquina, or Peruvian bark (fig. 129), this particular species having been only met with near Loxa, and in a small district in Peru. This tree grows at the elevation of from 11,000 to 15,000 feet above the sea. Beyond Loxa, the Andes once more divide into two ridges; and in the eastern or inland Cordillera, we meet with the gigantic Chimborazo, whose dome-shaped summit, which attains the altitude of 21,440 feet above the sea, was long considered the most elevated point on the surface of the globe, though it is now known that this mountain is surpassed in elevation by many other peaks, both in the Andes and in the Himalayah Mountains. The western, or maritime division, of this portion of the Andes, contains the splendid cone of Cotopaxi.

* This hairy tapir cannot but remind the geologist of the hairy mammoth and hairy rhinoceros of the Later Tertiary Period.

The two ridges next unite in the narrow ridge of Chisincha, but ere long branch off into two ranges, between which is situated the elevated table-land of Quito*. This extensive plain, notwithstanding its equatorial situation, enjoys a singularly mild and delightful climate, the heat being tempered by its elevation of about 9000 feet above the sea, whilst at the same time it possesses the advantages imparted by an intertropical situation. Vegetation here never ceases, and such is the verdure of the meadows and trees, that it has acquired the name of "the Evergreen Quito." All the productions of temperate climates succeed in this plateau, and the cerealia, which will not thrive in the low plains, here arrive at great perfection. The introduction of wheat is, according to De Humboldt, traced to three or four grains, which a negro servant of Cortez picked out among the stores of rice, sent from Europe for the supply of the troops. These grains were sown in the garden of the monastery of Quito; and the earthen vessel in which the first crop was gathered, was, at the period of De Humboldt's visit, still preserved as a precious relic by the monks of that place. The mountains which surround Quito, include a vast assemblage of snow-clad summits, no less than eleven *nevadas* being visible from that plain; among which, in the Eastern Cordillera, we meet with the volcanic cones of Cayambe and Antisana; and in the Western Cordillera, with that of Pichincha.

To the north of this magnificent group, the Andes again unite into one undivided range, following the line of the coast, until they approach the city of Almaguez, at which point vast ranges diverge from the central line, with which they do not again unite.

" Among the majestic scenery of the Andes," observes De Humboldt, " the *valleys* most powerfully affect the imagination of the European traveller. The stupendous mountains can only be seen from the low islands on the sea-coast, at a great distance from the main chain. The elevated plains from which

* Quito is now called the department of the Equator, on account of that line passing through this territory.



Natural Bridge of Icononzo.

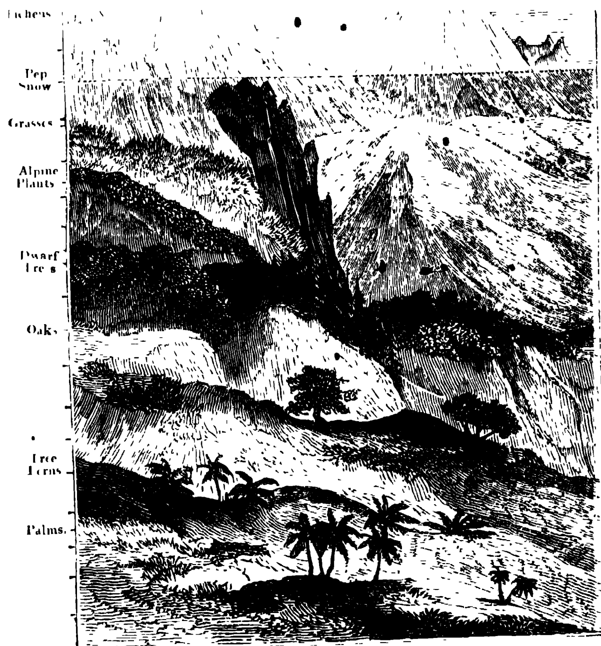
the detached summits of the mountains rise, are, for the most part, from 8000 to 10,000 feet above the level of the sea. This circumstance, in some degree, lessens the effect produced by the colossal masses of Chimborazo and Cotopaxi, viewed from the lofty plains of Riobamba and Quito." The valleys intersecting these mighty mountains are equally remarkable for the wildness and terrific character of their scenery, as for their great depth. The valley of Chota is nearly 5000 feet in perpendicular depth, and so precipitous are its sides, that it may be considered rather as a ravine than a valley. The valley of Icononzo is of much smaller dimensions: but on account of its two remarkable natural bridges, is regarded as an object of great interest. The depth of the crevice (through which a torrent gushes, forming two cascades) is nearly 320 feet, and its width 48 feet. Across this crevice extend these two natural bridges; the upper apparently consists of an undisturbed mass of rock, continuous with the strata forming the sides of the crevice; but the lower bridge consists of three enormous masses of rock, which have fallen down so as to meet in their descent and form an arch.

We now find the Andes divided into three ranges: the Western, Central, and Eastern Cordilleras. Of these the Western Cordillera may be considered as the prolongation of the Central Line. This portion of the Andes continues in an unbroken ridge, until it becomes depressed near the mouth of the River Atrato, which forms the line of demarcation between South and Central America. This Cordillera contains no very lofty summits; but the Central Cordillera is more elevated, and includes the Pic de Tolima, which is the most lofty peak met with in the Andes north of the Equator, being 18,314 feet above the sea. The Eastern Cordillera extends towards Santa Fé de Bogota, which is situated on a plain 8700 feet above the level of the sea. The mountain system of the Andes is considered to terminate in this Cordillera, with the elevated Sierra de Merida. An extensive diverging branch, however, (to which we shall have occasion again to revert,) stretches along the northern coast of Colombia.

The vegetation of intertropical America is equally splendid, rich, and varied. Owing to the vast undulations of its surface, the plants of hot, of temperate, and of arctic climates, occur within a limited portion of territory; and this region affords a most striking illustration of the range of various plants at different elevations above the level of the ocean.

The vegetation under the equator has been divided into six zones: the first is that of the *palms*, which extends from the level of the sea to the elevation of 3600 feet. In this zone, with the various palms, grow the banana or plantain, the cacao or chocolate tree, the liliaceous plants, &c. The second zone is that of the *arborescent* or *tree-ferns*, and *quinquinas*. The arborescent ferns range between 1300 and 5000 feet*, but the quinquinas extend much higher. With the tree-ferns grow the sensitive mimosas, the arborescent passion flowers, (said to equal British forest trees in size,) the large blue-flowered melastoma, and a vast variety of splendid and beautiful flowering plants. The third region is that of the *deciduous oak*, which terminates at 9000 feet. This tree appears to be the only plant which loses its foliage in this region of perpetual vegetation. It is, however, on this account, peculiarly gratifying to the eye of the European traveller, the tender green of its early leaves affording him a reminiscence of the spring of his native plains. In this zone we still meet with splendid passion flowers and melastomas; and the wax-coated palm accompanies the oak to its furthest limits. The latter tree, which frequently grows to the height of 180 feet, has its trunk thickly coated with wax, from whence its name. Beyond 9000 feet, the larger trees disappear; and the zone of *shrubs* and dwarf pines extends to 11,500 feet, and in a few favourable situations to 13,000; the ground in this part being richly adorned with

* In Hawaii, however, although that island is situated nineteen degrees north of the equator, the arborescent fern grows at a much greater elevation, extending on Mowna Koah to 8700 feet above the sea, thus affording a striking instance of the influence of an insular climate on this plant, and of its adaptation to thrive in higher latitudes in such situations: a fact of considerable interest to the geologist.



Scale of Vegetation

in Equinoctial America, according to the Elevation above the Sea, with the Summits of Chimborazo and Cotopaxi.

Height of Scale, 22,000 Feet.

lobelias and golden calceolarias. The fifth zone is that of *alpine plants*, which make their first appearance at about 6000 feet, and extend to 13,000 feet. These include the gentians, and ranunculuses, &c. The *grasses* and *herbaceous plants* succeed, and these in their turn disappear at 15,000 feet, after which *lichens* alone clothe the rocks; though some of the latter extend to the elevation of 18,000 feet, growing even beyond the limits of perpetual snow.

The mountain range of Venezuela, or Caraccas, which branches off from the Andes at the Sierra de Merida, extends along the coast of Caraccas, running parallel with the sea for five hundred miles, and terminating near the Gulf of Paria, in the mountainous island of Trinidad, which is considered as belonging to this range. The mountains of Venezuela consist of a series of ridges of moderate elevation, enclosing numerous fertile valleys; whilst between the mountains and the sea, a narrow low plain occurs, abounding in the most valuable tropical productions; but in many parts swampy, and swarming with myriads of tormenting insects.

In the calcareous mountains near Cumana, is situated the extensive and celebrated cavern of Guachara, presenting splendid and beautiful specimens of stalactites, assuming the most varied and picturesque forms. This cavern is inhabited by countless numbers of a species of nocturnal bird, called the Guachara bird: this bird is not, however, peculiar to this locality, also frequenting the crevices of the Andes. One of the most remarkable plants of this region is the palo de vaca, or cow tree (fig. 98). This tree grows luxuriantly in the more elevated valleys of Venezuela, the stem rising up majestically to the height of at least sixty feet, and being crowned with a noble head not less than forty feet in height. The leaves resemble those of the laurel, but are twelve or sixteen inches in length. When a deep incision is made in the bark, a white stream bursts forth, "in colour and consistence," says R. K. Porter, "in no degree differing from the milk of the cow; in taste, not less sweet and palatable; leaving, however, on the

tongue a slight bitterness, and on the lips a disagreeable clamminess."

To the south of the Venezuela range commence the vast plains of South America,

> Where blue savannahs melt into the sky,
> And forests frown in midnight majesty.

These immense plains, called in the native language *pampas*, and by the Spaniards *llanos*, both words signifying "levels," form one of the characteristic features of this portion of the New World. These savannahs are not, however absolutely flat, but consist of undulating ground, and many parts are marshy; but, excepting on the borders of the rivers, they are usually destitute of trees; though a few stunted plants of the *Curatella americana*, the rough leaves of which are used by the Indians in polishing their arrows and war clubs, and some *malpighiæ*, the bark of which the Brazilians use in tanning, are dispersed over the savannahs; but in consequence of their almost equal size, and thinly scattered foliage, they do not contribute to lessen the monotonous aspect of these plains, nor do they afford shelter to the weary traveller from the rays of the sun. During the dry season, these plains present in most parts the appearance of a parched desert; but after the rains they are covered with grasses and sedges, the former of which afford food to numerous herds of cattle. In some parts, however, coppices, or groups of trees, occur; during the annual inundations appearing like little islands in the midst of the surrounding waters, and in the dry season rising like oases out of the savannahs, these more fertile spots being nourished and supplied with moisture during the latter season, by the abundant dews, which form such a characteristic feature among the meteorological phenomena of most intertropical countries. These oases seldom exceed two miles in circumference, but often contain trees of considerable size. In their vicinity, among the plants requiring little moisture, and adapted to bear the full action of the sun, grow the agave and several erect and angular cacti: some of the latter appear in the form of huge

candelabras, whilst others overtop in height the surrounding trees, and are adorned with flowers remarkable for their beauty, or with fruit of inviting appearance. Many of these plains are intersected by small rills of limpid water, the banks of these streams being usually bordered by the majestic mauritia, or eta palm tree, and adorned by various beautiful flowers.

Compared with the stupendous range of the Andes, the mountains of this portion of South America are not remarkable for their altitude; they are, however, of sufficient elevation to impart a mountainous character to some parts of this region, and to form the separation between the basins or lowlands of the Orinoco, the Esequibo, and the Amazons; and the limits of these respective basins may be considered as definitely marked, by the water-shed towards each of the great rivers by which they are traversed.

In British Guiana the most remarkable mountains are the magnificent and picturesque group, of which Roraima forms the most elevated summit. This mountain attains the height of 9500 feet above the sea, and its upper portion presents a remarkable mural precipice, 1500 feet in height. This mountain range abounds in cascades, which eventually form tributaries to the three important rivers, the Orinoco, the Esequibo, and the Amazons. British Guiana was the El Dorado of Sir Walter Raleigh, the mountains having been described as resplendent with particles of the most precious metals. But

. . . . The telescope of truth
Which strips the distance of its phantasies,

has dispelled this illusion, divested this region of gold of its imaginary metallic treasures, and revealed to us, that this supposed precious ore was nothing more valuable than the shining particles of mica, which occur in great abundance in the granite mountains. This region, indeed, appears in a remarkable degree to have been made the subject of fiction, or exaggeration; for a vast lake stretching far into the interior, was supposed to exist in this locality, and accordingly figured for centuries on the maps of Guiana; but this mysterious lake has now altogether disappeared, or faded down into the exten-

sive savannahs, (bounded by the Carawaimi, Canacu, Paraima, and Parima mountains,) which were probably visited whilst in their state of annual inundation.

But although this region may not be a land of metallic treasures, it affords a rich field to the botanist; the vegetation of Guiana being most varied and luxuriant. It abounds in valuable timber trees, and in many parts on the borders of the rivers, "the forest reigns triumphant," rising like a wall on each side of the stream; the outline being only occasionally varied by the inroads which the stream has made, undermining and laying prostrate many a lofty tree, possibly to be borne down to the sea, and carried by the currents of the ocean, to Iceland, or to some other desolate shore, the exuberance of one region thus supplying the wants of another. Among the trees of Guiana, pre-eminently above all towers the majestic mora, which, according to Mr. Schomburghk, is equal, if not superior, to the British oak for ship-building. The trunk of this tree often exceeds ninety feet in height, and its summit is occasionally crowned by an unusual parasite, the wild fig tree, which takes root in some of the topmost branches, deriving nourishment from the sap; whilst the latter plant is, in its turn, again overrun by some of the various gigantic creepers which are so abundant in these forests. Another important tree is the mauritia, or eta palm, whose lofty stem supports numerous fern-shaped leaves, and a gigantic cluster of round fruit or seeds. This fruit, which is said to taste like cheese, forms a principal article of food among the natives; and indeed, every part of the tree is valuable; the fibres of the young leaves are woven into cordage, baskets, and hammocks; the old leaves thatch the house, the trunk forms the walls and the floors, and the pith of the leaf split up, makes a sail for the corial, or canoe.

Numerous other species of palm-trees are met with in this region; among which is the Attalea funifera, or chique-chique palm (fig. 18C), from which ropes are made. Here also we find the bombax, called also the silk cotton tree, or ceiba; the banana, from the fibres of which useful tree, a substitute for



Eta Palm.—Mauritia Flexuosa.

May 1.

flax is obtained; the lecythis, the inner bark of which affords an excellent substitute for tow; the Bixa orellana, from which the arnotto dye is procured; the fragrant Tonquin bean; the chocolate tree (fig. 36), which produces the cacao, or cocoa-nut of commerce; the vanilla (fig. 171), quassia, &c. The swampy sea-coasts are occupied by mangroves, which on the banks of the rivers are replaced by the water guava. We cannot pause to consider all the splendid and beautiful flowering plants of this region; but must not pass unnoticed the superb *Victoria regina*, which was discovered by Mr. Schomburghk, on the 1st of January, 1837. This magnificent plant grows in still water, and has hitherto been principally found in the River Berbice. Its gigantic leaf, which rests upon the water, is from five to six feet in diameter; the upper surface being of a bright green, and the under surface vivid crimson. The flower, which is fifteen inches in diameter, is at first of a pure white, with pink in the centre; by degrees, however, this pink tint spreads over the flower, and on the following day it assumes a uniform pink colour. It is also described as being fragrant. Orchideous plants and ferns are very abundant in Guiana; and Mr. Schomburghk mentions a curious cryptogamic plant, emitting a whitish phosphoric light, which after long continued rains, was observed in considerable abundance near his tent, covering the leaves and smaller branches of the trees, and quite illuminating the ground.

Among the native animals of this region, we meet with the howling monkey, the weeping monkey, and various other species of monkeys, the large vampire bat (fig. 7); the puma, jaguar, agouti, sloth, ant-bear, armadillo, opossum, tapir (fig. 71), &c. The birds are very varied and beautiful, and include the splendid orange-coloured rock manakin, the bell-bird, various parrots and humming-birds; the trumpeter, scarlet flamingo, &c. Fresh-water turtles are numerous; and the cayman or alligator (fig. 143) abounds in the streams. The iguana inhabits the sand-banks of the Esequibo; and in this region we meet with the gigantic Surinam toad (fig. 147). Many of the rivers and streams abound with the gymnotus, or

electric eel (fig. 156); and also with a great variety of fresh-water fish, among which is the beautiful crimson pira rucu, or sudis gigas, which is sometimes found fifteen feet in length.

The vast lowland, or basin of the Maranon, or Amazons, forms one immense and magnificent plain, sloping gradually and almost insensibly, downwards, from the base of the Andes to the shores of the Atlantic, and which is traversed by the mighty River Marañon, or Amazons*, and its numerous tributaries. The districts at the head of this basin, contain valleys of singular beauty and fertility; but the remainder of this lowland is occupied by immense and impenetrable forests, thickly interlaced with gigantic creepers, and extending almost uninterruptedly for at least 2000 miles in a straight line. In the less elevated parts of this plain, the trees attain the grandest and most noble dimensions; but as the basin gradually rises above the sea level, the trees as gradually diminish in size, until they become dwarfish and stunted in growth, and at last finally disappear; the extent of the mighty forest, being in fact limited by the zone of elevation above the sea level, at which the various plants, which are natives of this lowland, will ripen their fruit. Although by far the greater porion of this basin is occupied by these vast forests, "where the axe has never been heard," some tracts occur near the base of the Brazilian Mountains, which are nearly destitute of trees, and in other respects resemble the savannahs before described. These tracts are locally termed *sertam*, an abbreviation of "desertam."

The mountains of Brazil are of considerable extent, but not of great elevation, their average height not exceeding 2000 or 3000 feet, though some peaks are said to reach the altitude of 6000 feet. These mountains consist of several parallel ridges, generally running in a direction from north to south; but various collateral branches diverge to the eastward, forming the vast headland of South America, which extends from the northern part of the province of Pernambuco to Santa Cathe-

* This river is called the Maranon in the early part of its course, and Amazons after it enters Brazil.

rina. The scenery in this coast is generally beautiful, the shore in most parts rising immediately into

> Half circling hills, whose everlasting woods
> Sweep with their verdant skirts the shadowy floods

In the rear of these richly-fertile eminences, rise the mountains, assuming the most romantic and picturesque forms.

The districts which contain the rich deposits of gold and diamonds, for which Brazil is celebrated, are situated to the south of the principal range. The diamonds are not usually large, but very abundant; and topazes of great beauty, and considerable size, are met with. The chryso-beryl, the green tourmaline, or Brazilian emerald, as well as beautiful amethysts, are also of frequent occurrence. Iron and copper are said to abound in the interior.

To the south and west of this mountainous territory, extends the third vast lowland of South America, which may be considered as including the immense plains of La Plata, and also Eastern Patagonia. The plains, or rather the one vast plain of La Plata, presents, perhaps, the most extensive and unvaried level surface on the globe, being bounded on the west by the eastern slopes of the Andes, which in some parts rise with such abruptness, that the traveller is able to descry the base, as well as the pinnacles, of this mighty range; whilst the forest-clothed pampas are seen reaching to their very foot, and stretching interminably towards Brazil. In other parts, however, these pampas are covered with blown sand, without any rock, water, or trace of vegetation, the sand being formed into waving hillocks, resembling in shape the inner edge of a scythe; similar, it will be remembered, to those before described as occurring in the southern districts of Arabia. In other parts, these pampas are covered with crops of long grass extending for miles without being varied by a single weed: in others, again, they are occupied by immense beds of thistles, having, however, a rich under-bed of clover,—the latter being indigenous to this region, whilst the thistles are natives of Southern Europe, or Northern Africa, which have spread over these plains. A vast portion of the interior of this region

is unknown to Europeans; many large districts, with whose names we are hardly acquainted, but which abound in Nature's gifts, being situated in the mountainous country formed by the eastern declivities of the Andes. The scenery in those parts which have been visited, is described as particularly beautiful; the towering, snow-covered summits of the more distant Andes, their sharp peaks of various forms, heights, and sizes, forming the back-ground; the inferior mountains, green to their very summits; their upper portions being covered with forests of walnut, oak, red cedar, and lime trees; and their skirts clothed with thick forests of the various species of trees peculiar to hot climates. Numberless streams also dash down the sides of these mountains, whilst occasional openings of vast quebradas, or ravines, impart an air of magnificence and grandeur, by the alternation of gigantic masses of light and shade. These districts abound in the richest mineral treasures; coal is also met with, and inexhaustible deposits of salt. Among the trees more peculiar to this region, is the *mistol*, which is a large branching tree, the fruit of which, described as resembling a Kentish cherry, forms a considerable article of food with the natives.

A rich tract of country extends between the rivers Parana and Uruguay; and in this district grows the famous Paraguay tea-tree (fig. 126), which is a species of ilex, the leaves of which are said to form a fair substitute for the Chinese tea-plant. Between Buenos Ayres and Cape Corrientes, the country is also rich and varied, diversified by hills and well supplied with water. Beyond this, however, the surface becomes flat and less fertile; and as we approach the Rio Negro, the country appears remarkably destitute of both animal and vegetable productions; and scarcely any other plants are met with on the banks of that river, except a fringe of low willows.

To the south of the Rio Negro extends the territory of Patagonia: the general character of this country, appearing to be that of a succession of desolate steppes, or level plains, of various elevations. Sea-worn pebbles cover the greater portion of these plains, which are destitute of trees; thorns and

prickles, a few withered shrubs, and a yellow kind of herbage, constituting the sole vegetation, excepting near the River Santa Cruz, which, however, is not much more prolific in animal and vegetable productions than the Rio Negro, scarcely a bird or any other animal appearing to enliven the scene; though the guanoco, a species of llama, and the rhea, or American ostrich, are here occasionally met with. Towards the base of the Andes, the country improves in character, and the vegetation becomes more varied: and in this part, apple-trees are mentioned as being remarkably abundant.

The animal and vegetable productions of Brazil, contrast strongly with those of the desolate Patagonia; indeed, Brazil may be regarded as the region of flowers, birds, and insects. Nature, in this territory, is displayed in her gayest and most brilliant colours, as well as most varied and attractive forms. The never-ceasing power of vegetation causes the trees to shoot up to a majestic height, presenting, at the same time, an almost endless diversity of stem, leaves, and blossoms. Here we find the luxuriant lecythis, or lapucaya nut (fig. 18), with its singularly-formed fruit, resembling a pitcher; the bombax, or silk cotton tree (fig. 34), the citron, or lime (fig. 45), the Siphonia elastica, or caoutchouc tree (fig. 50), the purple-flowered cæsalpina (fig. 68), producing the Brazil-wood of commerce; the feathered jacaranda (fig. 74), with its gold-coloured flowers, which yields the well-known timber called rose-wood; the trumpet tree; the shining-leaved Sapindus saponaria, or soap-tree, the nuts of which are frequently strung for rosaries, and which are commonly known as "soap-beads;" a name they have acquired from the occurrence of a glutinous pulp, between these seeds and the outer rind, which is used by the Indians as a substitute for soap*. In this region, we also meet with the Bertholletia excelsa, crowned with its valuable nuts, called Brazil nuts; and with groves of orange, myrtle, coronilla, &c. The banana, or plantain (fig. 167), also;

* These nuts, or seeds, are said to be so poisonous, that caution is required in handling them.

besides various species of palm (figs. 173, 181, 182, 186), and the aboresccent fern. The mandioc, or cassava-root (fig. 49), from which tapioca is obtained, the Convolvolus batatas, or sweet potato (fig. 128), the pine-apple (fig. 170), also flourish in this region, with a vast abundance of climbing and parasitical plants, among which are the gigantic bejuco, and the superb flowers of the orchideæ, the air-plants, bromeliæ, tillandsiæ, and a multiplicity of curiously-formed ferns. The swampy districts near the sea-coast, like those of other tropical lands, are covered with forests of mangroves; and in the rivers of La Plata, reeds grow to an enormous size.

Among the animal productions of Brazil, we are struck with the number and variety of the monkey tribe; no less than sixty-five species being described as natives of these forests, all differing from any in the Old World. The bats also are exceedingly numerous; and among these, some feed solely on fruits, but others, the true vampires, suck the blood of animals, and even of man. The ferocious quadrupeds are mostly of small size, and not very abundant in species. The largest of this tribe are the puma, or cougar (fig. 12), sometimes, as before-mentioned, erroneously called the American lion; and the jaguar (fig. 14), also erroneously called the American panther. Besides these, we meet with the ocelot, and several elegantly-marked tiger-cats. The coati-mondi (fig. 33) is also an inhabitant of this region; where we likewise meet with a species of opossum; with the Brazilian porcupine (fig. 55*), which differs greatly from the common porcupine, and is furnished with a prehensile tail; the Patagonian cavy (fig. 56), capybara (fig. 57), sloth, or ai (fig. 58), armadillo (fig. 59), chlamyphorus (fig. 60), ant-eater (fig. 61), tapir (fig. 71), peccari, or bush-hog, &c. The llama has already been mentioned, and small deer are also said to occur in some parts.

The Brazilian woods are crowded with feathered inhabitants;

And through the forests' deepening glooms,
Birds of illuminated plumes,
Come forth like stars on summer night.

Among these are innumerable parrots and parrokeets; the splendid mackaw (fig. 121), which frequents the palm, whose stone-like fruit it cracks with great facility; the toucan (fig. 122), the trogons, the hang-nest oriole, the manakin, araponga, familiarly called the blacksmith, or bell-bird, from the loud note which it utters, resembling the stroke of a hammer on the anvil, or that of the clapper of a bell; various chatterers, woodpeckers, and creepers; innumerable humming-birds, whose brilliant hues vie with the richly-tinted flowers around which they hover, &c. In the neighbourhood of the rivers, we meet with the scarlet flamingo (fig. 131), the pelican (fig. 133), spoonbill, gigantic crane, &c., whilst the rapacious birds present us with the great destroying eagle, one of the most formidable of the feathered tribe; the king vulture, and various owls, among which are the supercilious, or horned owl, and a small species, not much larger than a sparrow.

Alligators (fig. 143) occur in great numbers in some of the rivers; and serpents also abound in some parts. Among the latter, is the anaconda, of which there are three species, including the boa-constrictor (fig. 149). Frogs are innumerable in some localities, and their croaking is almost deafening. These animals, as well as toads, are of unusual size in South America: and a species of frog seen by Mr. Swainson, is described by him, as "certainly bigger than the head of an ordinary man."

The insects of Brazil are not less splendid than its birds; the butterflies and moths are of a size and brilliancy unrivalled by any in the whole world; and six or seven hundred species are known, which are peculiar to this region. Many of the beetle tribe are remarkable for their grotesque appearance, and others no less for the splendour of their colours. The diamond-beetle is well known; but this is said to be quite eclipsed in splendour by two others of the same genus, which inhabit the southern provinces. The great fire-fly is a denizen of these woods. Ants are very numerous and destructive to man; scorpions and centipedes occur, but not of large size. Spiders of enormous size inhabit this region; and Lieutenant Smyth

observed in the lowland of the Marañon, a spider's web of gigantic dimensions, which measured fifty feet in length, and twenty-five in height. The threads were very strong. It, however, did not appear to be the work of an individual spider, but to belong to a whole family, or republic of spiders, which must be singularly social in their habits, to form such an establishment.

The New Shetland Isles, though separated from America, appear to form a continuation of the mountain system of that continent, their geological formation being generally precisely similar to that of Tierra del Fuego. They are mostly mountainous, and present a most dreary appearance, being in many parts covered with snow to the water's edge, and nearly destitute of vegetation. The New Orkneys, Enderby's Land, and Sandwich Land, all appear to present a similar forbidding aspect. Trinity or Palmer's Land, and Graham's Land are little known; the latter appears to be of considerable elevation, and is supposed to consist of continuous land. Biscoe's range, which is a group of islands lying to the west of Graham's Land, includes the beautiful and imposing Adelaide Island, which consists of one elevated snow-clad peak, shooting up into the clouds, and of a lower range of mountains, remarkable for having only a thin covering of snow on their summits, though towards their base, they are buried in a field of ice and snow of dazzling brightness. Near the water's edge, a ledge of rocks occurs, riven and splintered in every direction, as if by some violent convulsion.

Owing to the great degree of cold, which, as has been before observed, prevails in the high latitudes of the southern hemisphere, these islands are almost destitute of organized productions. The New Shetland Isles are situated in a lower parallel than Drontheim, in Norway, which it will be remembered is the northern limit of the cultivation of wheat; but, so severe is the climate of these southern lands, that the only vegetation consists of a few lichens and mosses. No living quadrupeds have been found; and a very small number of birds; the latter consisting chiefly of penguins (fig. 138), and a species of pigeon.

CHAPTER XXI.

GENERAL FEATURES OF CENTRAL AMERICA.—MEXICO.—GUATEMALA.—WEST INDIAN ISLANDS.

There, groves that bloom in endless spring
Are rustling to the radiant wing
Of birds, in various plumage bright
As rainbow-hues, or dawning light.
And from the fruit-tree spreading tall
The richly-ripened clusters fall
Oft as sea-breezes blow.—WILSON.

CENTRAL AMERICA, properly so called, consists of an extended strip of land, stretching from north-west to south-east, separating the waters of the Atlantic from those of the Pacific, and connecting the two vast peninsulas of North and South America. The natural limits of this territory are marked, on the one hand, by the narrowest part of the isthmus of Panama, and on the other, by the isthmus of Tehuantepec. As, however, the physical features of the extensive territory of Mexico agree in many particulars with those of this portion of the New World, that region may be advantageously considered in the same division; in which we shall also place the large and important assemblage of islands, included under the general name of the West Indies.

The grand central mountain range, which in North America bears the name of the Rocky Mountains, and in South America, that of the Andes, may be traced through the whole of Mexico and Central America, but does not, in any part of these regions, attain the lofty elevation to which it rises in those vast and extensive mountain systems. In Mexico, the central line is continued in an elevated plateau, which constitutes the highest portion of the ridge, being on an average about seven thousand feet above the level of the sea, and extending from one extremity of Mexico to the other. This plateau is traversed, nearly at right angles, by a chain of active volcanos, some of

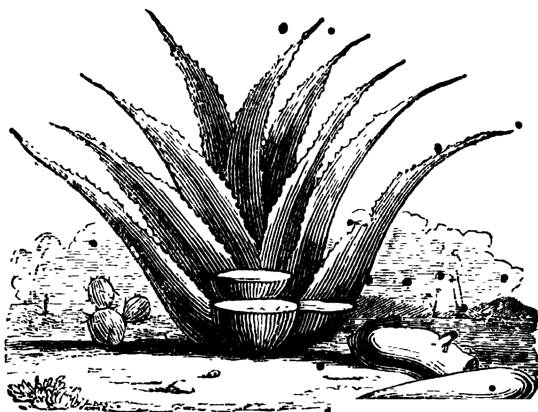
which are of great elevation, and which extend from east to west.

Mexico is rich in mineral deposits; iron, copper, lead, and mercury occur in some parts; and gold is also met with; but the most celebrated deposits are the silver mines, which are about three thousand in number. The mean annual produce of the latter mines is estimated at 1,500,000 lbs; a quantity considered equal to two-thirds of the silver annually obtained from the bowels of the earth over the whole surface of the globe.

Mexico, owing to its geographical position, and also to the peculiar configuration of its surface, presents some remarkable features in its natural productions. The most elevated parts of its high table land are absolutely devoid of vegetation. This is not, however, attributable to its altitude, and consequent low temperature; its elevation not being sufficient to produce this effect, in the parallel in which it is situated; but is apparently caused by its want of moisture, which in great measure arises from the porous nature of the rocks. The surface is also covered with a saline efflorescence, which increases its unfitness for vegetation. As soon, however, as any slopes occur a more humid climate prevails, and these districts are adorned with vegetation of extreme variety and beauty. The central portion of the plateau is traversed by numerous valleys, the wide basins of which are usually not more than one thousand feet above the level of the sea. In the more elevated parts of these valleys, the steep declivities are occupied by forests of pine, oak, and beech, whilst the basins are adorned with the graceful foliage of the farm, and other tropical plants. And thus, the traveller, passing down one of these magnificent ravines, finds himself almost suddenly transported from the midst of the productions of temperate climes, to those of the torrid zone.

Among the vegetable productions of Mexico we meet with many North American species; but its flora has, on the whole, a greater similarity to that of South America. Thus, in the valleys, we meet with the caoutchouc tree, the cow-tree, the

banana, vanilla, agave, or American aloe (fig. 168), &c. The most characteristic feature, however, of the Mexican flora, is the vast abundance of plants of the cactus kind, the latter succulent plants being adapted to flourish in the more arid districts. From the agave, or American aloe, called also the maguey,



The Agave, as prepared for producing Pulque.

the natives prepare a fermented liquor, called *pulque*. This plant, though growing on the most arid spots, where scarcely any soil covers the rocks, is remarkable for the enormous supply of sap it yields, of which the pulque is made. This sap, or "honey," as it is termed, is obtained by cutting out the central or flowering shoot, at the same time leaving the outside leaves to form a cup. Into this receptacle, the abundant sap designed to nourish the flower, rises in great quantities, and, being set to ferment, it forms the pulque. From the fibres of the leaves of the agave, was made the paper on which the ancient Mexicans painted their hieroglyphics. Many of the half-hardy plants which adorn our gardens, are natives of the temperate regions of Mexico; and among these the dahlia holds a conspicuous place. Barley and rye succeed on the higher lands; and the

wheat of Mexico is considered to excel that of all other countries, whilst maize arrives at the greatest perfection in the valleys. The banana, however, forms a very principal article of food, and the mandioc, or cassava-root, is much cultivated.

The assemblage of animals usually met with in different regions, forms a very striking feature in the zoology of Mexico. "Here may be seen," says Dr. Richardson, "wolves of northern aspect, dwelling in the vicinity of monkeys; humming-birds returning periodically from the borders of the frozen zone, with the northern buntings and soft-feathered titmice, to nestle with parrots and couroucuis; our common European whistling duck, shoveller, and teal, swimming in lakes, which swarm with sirens; and wherein the northern phaleropes seek their food, in company with Brazilian parras and boat-bills; associations which occur in no other region of the earth." But, although the central situation of Mexico, and the configuration of its surface, causes its fauna to display some unusual features, it is not exempt from the universal laws regulating the distribution of animals, and is capable of division into three zones, or regions—the cold, the temperate, and the hot. In the elevated *cold* region, the fauna assumes a northern character. The fields abound with hares, the woods with squirrels; there also we find some of the weasel tribe, and a wolf resembling the Canadian species. The Virginian horned owl, the common barn owl, and other rapacious birds occur; whilst snow-buntings, finches, &c., occupy the woods, and several of the northern ducks cover the extensive alpine lakes. In the *temperate* region, deer, opossums, and some species of squirrels, abound; and among the birds, are thrushes, hedge-creepers, and warblers. The *hot* and low maritime tract, and the interior valleys, nourish numerous South American species, such as howling monkeys, armadillos, ant-eaters, coatis (fig. 33), peccaris (fig. 73), jaguars, and ocelots (fig. 15), besides mackaws, parrots, tanagers, and various other birds commonly met with in the Brazilian region. Sixty-eight species of land birds have, however, been described as peculiar to Mexico. The insects are little known; though one species, the cochineal,

must not be passed unnoticed. This insect is met with, or has been introduced into other parts of the world; but it is only in Mexico, that it has been cultivated with complete success for the beautiful dye it affords. It is not improbable that the difference may be owing to the food of the insect, which, in Mexico, consists of a species of cactus (fig. 23), called the nopal tree. At one period above 2,000,000 lbs of these little insects were annually exported from Mexico.

Central America Proper comprises the territory of Guatemala. The grand range of mountains, which we have observed forming the high table-land of Mexico, extends into this country, in which, however, it becomes twice depressed. It retains its elevation in the north-western part of Central America, and first loses its great altitude near Nicaragua, though it again rears itself in the province of Veragua, where it is crowned by a very fine plain, or table-land. In the eastern part of this province, however, the range becomes broken into detached mountains of considerable height, and of the most abrupt and rugged form. Beyond these appear innumerable conical hills, not exceeding three hundred or four hundred feet in height, surrounded by plains and savannahs; at length these hills disappear, and for a few miles the country becomes uninterruptedly low and flat. Ere long, however, the conical hills reappear, and gradually thickening, at length unite, and form a small mountain range of some elevation, which extends from Porto Bello, (or Puerto Belo,) to the bay of Mandingo, where a second depression occurs. The land from this point continues comparatively flat, through the provinces of Darien and Choco, in which part the only indication of the ridge, consists in the water-shed; the rivers on one side flowing into the Atlantic, and, on the other, into the Pacific. The narrowest portion of the isthmus is near the city of Panama, where it does not exceed thirty miles in width. The mountains in this part are not more than one thousand or eleven hundred feet above the sea; but are more elevated near Porto Bello, where they are mostly covered with thick, and almost impenetrable,

forests. The base of the range on either side, is skirted by low plains of alluvial formation, presenting generally flat and swampy districts, uncongenial to European constitutions, and swarming with mosquitoes, but producing the most luxuriant tropical vegetation. Nineteen active volcanos occur in this region, which is also subject to violent earthquakes.

In a country with a climate so unhealthy, and subject to such fearful visitations, we might almost expect that man would scarcely be induced to fix his abode; but its natural productions are so rich and varied, and the climate, in the more elevated districts, so totally differs from that of the low plains, being peculiarly delightful and salubrious, that its attractions are very considerable. Central America abounds in metallic deposits; gold and silver have been found in all the mountains that have been examined; and Costa Ricca (the Rich Coast) has acquired its name from the gold and silver mines situated in that district. Zinc, nickel, antimony, copper, iron, and lead, are also met with.

The vegetable productions of Central America bear a general resemblance to those of Mexico; and vegetation varies in its cold, temperate, and hot regions. In the higher parts all the cerealia flourish, and nearly all the fruits and vegetables of Europe; whilst the productions of the flat country, besides many very valuable plants, peculiar to its own soil, include most of those occurring in the West Indies, such as the mahogany (fig. 42), logwood (fig. 69), chocolate tree, &c. Among those peculiar to this region, is a species of chesnut, the fruit of which contains a large supply of oil, of which candles are made, said to resemble wax, and to burn with a remarkably clear and steady light. The hand-plant is a native of this region, where it forms vast forests. The zoology of Central America is little known, but we may mention the guana, or iguana (fig. 145), as an inhabitant of the warm districts.

The large and fine group, or rather groups of islands, included under the name of the West Indies, are distinguishe for their rich products. These islands are generally of mountainous character; each island usually consisting either of a



Chocolate Tree.—Theobroma Cacao.

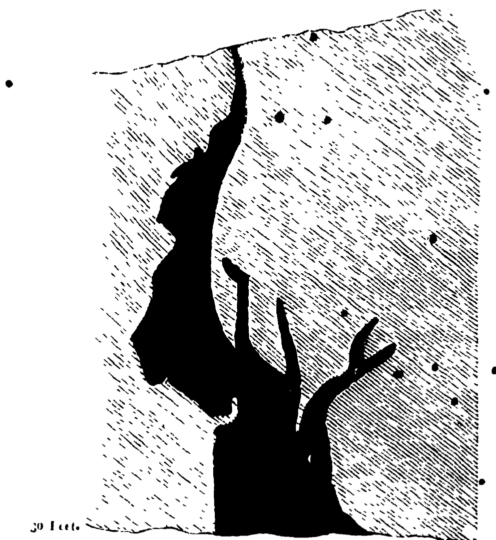
single mountain, the slopes of which, with the plains at its base, constitute the island; or of a more continuous range, presenting similar general features.

The greater number of these islands appear to be of volcanic origin; though the minute coral polypus, the Madrepora muricata (fig. 177), has also contributed largely to their formation; and coralline rock is not unfrequently found, alternating with layers of volcanic matter, and, in some instances, forming the uppermost stratum of an island. The remarkable, and in the economy of nature, important animals, to whose labour the formation of these limestone rocks is attributed, are adapted to dwell only at a certain and restricted depth under water, and

cannot exist above its surface; it might, therefore, at first sight, strike us as very extraordinary, and almost unaccountable, that elevated land, apparently of recent origin, should be composed of this substance. But, when we take into consideration, the vast convulsions to which this region is subject, (a point to which we shall presently direct our attention,) and the elevation and subsidence of land, frequently caused by such commotions, we shall not hesitate to agree with Mr. Darwin, that successive subsidences of the land, may have rendered the summits, whilst still under water, suitable localities for the coral polypi, and that thus these vast accumulations have been formed: and finally a whole island, or islands may have been subsequently upheaved, and raised to the present position above the level of the sea.

The large island of Cuba contains deposits of native gold, of silver and copper. In the same island a remarkable deposit of bituminous coal has recently been discovered, which instead of occurring in beds or strata, is described as occupying a *vein*, presenting the appearance of having been filled from below. This coal is said to be wholly unaccompanied with traces of vegetable matter, and to burn with much flame and smoke. The vein commences, or *crops out*, immediately under the thin alluvial soil, and occurs in the igneous rock called serpentine, but is bordered by soft clay. As far as this singular deposit has been traced, it follows an irregular, but nearly perpendicular direction: it has been explored to the depth of thirty feet or more, and increases in thickness in the lower portion. This substance is wholly unaccompanied by beds of shale, and lies in parallel horizontal layers, having a conchoidal fracture. A similar formation has been found in another part of Cuba, about eighteen miles distant from Havaña. Petroleum also occurs in great abundance in the same vicinity, rising in the form of springs from the serpentine rock. Asphaltum is met with in considerable quantities on the shores of the Bay of Havaña, and is employed, like tar, for pitching vessels. It is a curious fact, that Havaña was originally called *Carine* by the discoverers and early occupiers, because they there *careened* their

ships and pitched them with the natural tar they found on the shores of this beautiful bay.



Section of a Vein of Bituminous Coal in the Island of Cuba

The asphaltum, or pitch lake of Trinidad, has long been celebrated. It is about three miles in circumference, and situated in a clayey soil, appearing to be supplied by bitumen springs. In the hot season, this lake is in a state approaching to fluidity; but in the rainy or cool season, it is sufficiently solid to bear any weight.

Situated as these islands are, within the tropics, and possessing the advantages of an insular and moist climate, their vegetation is of the most beautiful and splendid description. Here the various palm-trees,—the cocoa-nut palm, date palm, and cabbage palm,—rise majestically, accompanied by the fern-tree, the pandanus, or screw-pine, the avocado pear, the Myrtus pimenta (fig. 15), which produces the allspice, or pimento of

commerce; the banana, mango, calabash (fig. 134), teak, mahogany, and the papaw tree, the milky juice of whose fruit possesses the remarkable property of making tender any meat steeped in water impregnated with it; nay, the very vapour of the tree serves the same purpose; and it is said to be customary in Barbadoes to suspend the meat and fowls on its branches, to prepare them for the table. Innumerable cacti and euphorbiæ are also met with, as well as fantastically-shaped orchideous plants. Climbing plants are also in great profusion, ascending to the tops of the loftiest trees, and hanging in wild profusion from their branches. Among these may be mentioned the passion flower, of which there are four species, all of great beauty, and producing the fruit called in the West Indies, the grenadilla. The pine-apple is a native of these islands, though the mammee is considered one of the best West Indian fruits; it is described as being in appearance not unlike a russet-apple, but with pulp resembling a fine apricot, and with a delicious flavour. In this region also grows the maranta (fig. 166), from which arrow-root is obtained; whilst the spice plants, ginger (fig. 164), and other productions of distant intertropical regions, have been introduced into these islands, where they thrive luxuriantly. In these islands we find also the deadly manchineel (fig. 54), under whose poisonous influence not even a blade of grass will grow.

The native animals of the West Indies are little known; but among the most remarkable of those with which we are acquainted are the agouti, (considered as the representative of the hare,) the common iguana, and the iguana lizard. The green turtle (so called from the colour of its fat, and held in high estimation by epicures) is a native of these shores.

The birds bear much resemblance to those of the neighbouring mainland: and of all the islands Trinidad appears the most prolific in the feathered tribes. The humming-bird, the "fairy king of flowers," in that island presents some of its splendid varieties; among which are the ruby-topaz, the ruff-necked and the emerald-crested. Pelicans, great white herons, and flamingoes, frequent the salt marshes.

It is a general remark, that in islands, the species of insects are less numerous than on continents; nor do the West Indies present any of particular interest. Many of our readers may be familiar with the little round substances, having the appearance of grains, or seeds of gold, which are frequently sent over in boxes of small shells. These little gilded grains have been discovered to be the chrysalis case of an insect, which dwells among, and preys upon the ants. On close examination, a small hole will be perceived, through which the insect has effected its escape.

CHAPTER XXII.

VOLCANIC REGION OF AMERICA.

The dread volcano ministers to good;
Its smothered flames might undermine a world.—YOUNG.

THE volcanic region of the Andes exhibits the phenomena of earthquakes and volcanos, on the most appalling and magnificent scale. From the island of Chiloe, (situated to the south of Chili,) to the north of Mexico, a vast area extends, in some parts of which, earthquakes and volcanic eruptions occur uninterruptedly. Nor, in fact, do these limits appear to form the actual termination of this volcanic region, for, though perhaps not in equal energy, traces of these commotions may be observed extending both further northward and southward: and it is not impossible that future investigations may disclose, that the volcanic band stretches with greater or less force, along the whole continent;

From the Antarctic, from the Land of Fire,
To where Alaska's wintry wilds retire.

That it does extend to the "Land of Fire," or Tierra del Fuego, is, perhaps, not merely conjectural; the appearance of vivid flashes of fire, observed by Captain Basil Hall, off that

island, seeming clearly to indicate the existence of an active volcano, at no great distance from the Beagle Channel. And, that volcanic action extends almost to the Antarctic itself, is also evident, from the volcanic nature of Deception Island, one of the New South Shetland group, and from the indications of subterranean heat observable in that island.

We have already seen that these islands, from their general geological formation, appear to form a continuation of Tierra del Fuego, and that they are mostly covered with snow to the water's edge. In this respect, however, the volcanic island of Deception differs from the others, being in great measure denuded of its snowy mantle, a circumstance apparently attributable to the warmth of its soil, which is black and composed of cinders. The shape of this island is one of common occurrence in volcanic formations, that of a nearly circular shell, inclosing a bay, or inland sea. The principal part of the island, is formed of alternate layers of ice and volcanic ashes, thus conveyed the impression, that the snow of each winter had, during a series of years, been preserved between layers of cinders. That volcanic action is still in force, at least internally, in this island, appears from the circumstance, that not less that 150 chasms, or fissures, occur, from which steam issues with a loud hissing noise. The beach also abounds with hot springs; in some parts affording the extraordinary spectacle of water, at the temperature of 140°, issuing from beneath the snow-clad surface of the soil, and pouring into the sea, which, by this means, has its temperature raised above that of the surrounding waters.

Several active volcanos are said to exist in the Andes of Patagonia, but the most southerly of which any certain account has been given, is the flat-topped volcano of Yanteles, in front of the island of Chiloe.

The province of Chili contains at least nineteen well-known points of eruption, situated in a continuous line along the ridge of the Andes, in which, many of these volcanic cones form lofty summits. Among these we may mention, as the most remarkable, the elevated Villarica, which continues burning

without intermission; the lofty Aconcagua, whose summit is almost always covered with snow, and the Petroleum volcano, from whence a stream of that mineral pitch continually flows. This territory also exhibits the energy of subterranean heat to a remarkable degree, in the phenomena of earthquakes; a year never passing without several shocks, whilst convulsions of the most tremendous description have from time to time occurred; in some instances, agitating the whole country from one extremity to the other, and permanently raising continuous tracts of land from one to twenty feet above their former level: but destroying the works of man, and not unfrequently involving him in their ruin. Nor are these awful convulsions confined to Chili; they extend continuously in full energy along the whole line of the Andes; from the southern extremity of Chili, to their northern termination. And so far from being of less frequent occurrence in the present day, these catastrophes have been repeated at shorter intervals since the commencement of the nineteenth century, than at any former period on record. After the first discovery of those countries, an idea prevailed, that these convulsions of the earth's crust occurred at intervals of a century; afterwards it was supposed, that about fifty years was the term which usually elapsed between violent earthquakes; but recent facts clearly prove, that their occurrence is far more frequent, and at no fixed term. Thus, severe earthquakes have occurred at Caraccas, in the year 1812; at Copiapo, in 1818; at Santiago, in 1822; at Bogota, in 1827; at Lima, in 1828; at Santiago, in 1829; at Huasco, in 1832; at Concepcion, in 1835; and at Valdivia, in 1837. And the mighty effects produced by some of these tremendous convulsions lead to the conclusion, that "the same causes are still in operation, which, ages since, raised tertiary formations to their present lofty site in the great range of the Cordillera." It may not be without interest to the reader, to consider some particulars of the most remarkable of these tremendous agitations of the earth's surface; those of November, 1822, and of February, 1835.

The destructive earthquake which occurred in November,

1822, and which greatly injured Santiago, Valparaiso, and several other towns, was felt simultaneously throughout a space of 1200 miles from north to south; and in the neighbourhood of Valparaiso, the coast, for the length of 100 miles, was permanently raised from three to four feet above its former level.

The area over which this permanent alteration in level, is conjectured to have extended, is 100,000 square miles; a space equal to half of France. The whole district, from the foot of the Andes to a considerable distance out at sea, is supposed to have been upheaved; the greatest rise being about two miles from the shore, where it appears to have been about five, six, or, in some places, seven feet. "If," observes Mr. Lyell, "we suppose the elevation to have been only three feet on an average, it will be seen that the mass of rock added to the continent of America, by the movement, or, in other words, the mass previously below the level of the sea, and after the shocks permanently raised above it, must have exceeded seventy-five cubic miles in bulk, which would be sufficient to form a conical mountain two miles high (or about as high as Etna), with a circumference at the base, of nearly thirty-three miles." The tremendous, though almost inconceivable, force required to effect this mighty movement, may be more forcibly impressed on our minds if we follow Mr. Lyell in his computation of the weight of rock which must have been raised. Taking the mean specific gravity, or density of the rock at about two and a half that of water, so that a cubic yard would weigh about two tons, Mr. Lyell computes that the rock added to the continent by this earthquake, must have more than equalled six hundred thousand million tons. "But," he continues, "it must be borne in mind, that the weight of rock, here alluded to, constituted but an insignificant part of the whole amount which the volcanic forces had to overcome. The whole thickness of the rock, between the surface of Chili and the subterranean forces of volcanic action, may be many miles or leagues deep." Assuming the thickness to be only two miles, Mr. Lyell proceeds to compute the weight of the

mass which must have been moved by this convulsion: but here, ordinary numbers altogether fail us, and we cannot but pause, filled with awe and admiration at the mighty energy of subterranean heat; or, more properly speaking, at the omnipotent and unseen Hand which directs its forces.

. . . . Thee, O Father, this extent
Of matter, Thee, the sluggish earth, and track
Of seas, the heavens and heavenly splendours, feel,
Pervading, quickening, moving*.

The great earthquake of the 20th of February, 1835, was felt at all places between Copiapo and the island of Chiloe, in a direction from north to south; and from Mendoza, on the eastern side of the Andes, to the island of Juan Fernandez, in a direction from east to west. But though the oscillations of the earth did not reach beyond these limits, the deep-seated subterranean volcanic agency appears to have extended much further; for the igneous vents of the whole range of the Andes are said to have been in remarkable activity, both preceding and at the moment of the convulsion. From the volcano of Yanteles, to that of Coseguina, in Central America, violent eruptions appear to have occurred throughout the whole line. The tremendous eruption of Coseguina (to which we shall again have occasion to refer) commenced on the 10th of January. On the 20th, the volcano of Osorno, north-east of Chiloe, burst forth with inconceivable fury. Aconcagua, Mayhu, Petoroa, and various others, were also in a state of great activity previous to the earthquake, whilst others burst forth shortly after its occurrence.

The earthquake commenced at half-past eleven in the morning, the atmosphere at the time being remarkably serene and beautiful. The inhabitants, however, were not wholly unprepared for the catastrophe; the flight of numerous flocks of sea-birds hurrying to the shore, warned them of the approaching convulsion, and the greater number quitted their

* The mode which Mr. Lyell adopts of computing the weight of matter elevated by this earthquake, is by a comparison of the mass with that of the great pyramid of Egypt. Assuming the latter to weigh, if solid, six million tons, the rock raised would exceed in weight 363 million pyramids!

dwellings, and retired to a place of greater security. It is also said that the dogs all quitted the sea-port of Talcahuano. The lives of nearly all the inhabitants were thus spared; but, had it not been for these warnings, how dreadful would have been the catastrophe; for, in *six seconds*, the city of Concepcion, the sea-port of Talcahuano, and some other places, were totally laid in ruins. One only house is said to have remained standing at Talcahuano; but this, unlike the others, which were built on a sandy or alluvial formation, was founded on a rock. "The stunning noise of falling houses," says Captain Fitz-Roy, "the fearful cracking of the earth, which opened and shut rapidly in numerous places, the stifling heat, the blinding and smothering clouds of dust, the extreme horror and alarm, can neither be imagined nor fully described." About half an hour after this fearful vibration, the sea, in the bay of Concepcion, retired so much beyond its usual limits, that all the rocks and shoals in the bay were visible, and some ships were left grounded, which had been previously lying in seven fathoms water. Shortly afterwards, an enormous wave was seen slowly approaching the shore. It rolled majestically on for ten minutes, giving the inhabitants time to escape to the heights, when breaking with tremendous force on the beach, it overflowed the whole of Talcahuano, carrying all before it, and rising to the height of twenty-eight feet above high-water mark: then retreating with an appalling roar, it bore out to sea every moveable article that the earthquake had not destroyed. A second and a third wave, each more enormous than its predecessor, succeeded; after which, though earth and water trembled, no additional destructive convulsions took place. During the approach of these great waves, submarine eruptions were observed in the ocean, and similar phenomena occurred off the island of Juan Fernandez. Throughout the whole of the provinces of Cauquenes and Concepcion, the entire crust of the earth was rent and shattered in every direction; circular pools, filled with salt water, were formed in some parts, and also extensive fissures. In other places, the ground swelled like a bubble, then bursting, poured forth

black sulphureous streams. An elevatory movement also took place; the little island of Santa Maria, in the bay of Concepcion, having been raised ten feet above its former level at its northern extremity, nine feet in the centre of the island, and about eight feet at the southern cove.

The sensation occasioned by the undulatory movements is described by Mr. Caldcleugh as being "similar to that which would be produced by standing on a plank, the ends of which rose and fell two feet from the ground." At Concepcion, previous to the most severe shocks, a violent report was heard to the southward, as if proceeding from a volcano in that direction.

In the midst of this scene of destruction, some very remarkable and providential escapes occurred. A mother hastily retreated with her children, immediately after the great shock, saw one of them fall into a hole; a wall, close to her, was tottering, she however pushed a shutter over the hole into which the poor child had fallen, and hastened onward with her other children. The wall fell, and covered the hole with masses of brickwork, but on the next day the child was taken out unhurt. The fate of another child was very remarkable. A servant maid had taken refuge with this little boy in a small boat; the enormous wave, on its retreat from the shore, swept off this boat, and dashing it against an anchor which was lying on the beach, divided it into two parts, one of which held the servant, and the other the child. The poor woman was drowned, but the little boy, who was only four years old, was carried out into the bay; he, however clung firmly to the fragment of the boat, and the little fellow was afterwards picked up, cold and wet, but quite uninjured.

Near the coast of this region of terrific earthquakes and volcanos, three volcanic islands were discovered on the 12th of February, 1839, situated between its shores and the basaltic island of Juan Fernandez. One of these islands, at the time of its discovery, appeared to be in the act of rising out of the sea.

The most northern of the Chilian volcanos is situated near

Coquimbo, between which place and Atacama, though the connexion is maintained by earthquakes, no igneous vent has been observed. Entering Bolivia, or Upper Peru, however, we find the Western Cordillera of the Andes presenting a series of active volcanos, the most remarkable of which is Gualatieri, 22,000 feet in height. Peru is subject to almost continual earthquakes, and scarcely a week passes without the occurrence of a shock. In 1746, the magnificent city of Lima was entirely laid in ruins by an earthquake; and at the same instant, the sea retired from the port of Callao, about six miles distant, and then returning with terrific impetuosity, totally destroyed that harbour, and changed the form of the coast. Four volcanos burst forth in the neighbouring mountains; and such vast torrents of water swept down their sides, that the whole country was inundated.

Colombia contains a series of stupendous volcanos, including the lofty cones of Cayambe, Cotopaxi, Pichincha, Antisana, L'Altar, and Tunguragua.

Cotopaxi is remarkable for the beautiful regularity of its form, which is that of a perfect cone, usually covered with an enormous coating of snow; though on some occasions this vast accumulation of ice and snow has been suddenly and completely melted during an eruption. Thus, in January, 1803, the snows on its summit were all dissolved in one night, giving rise to frightful inundations in the surrounding country. The eruptions of this volcano have been more frequent and more destructive than those of any other in the Andes.

A very tremendous eruption occurred in the volcano of Tunguragua, on the 4th of February, 1797, which was accompanied by a violent earthquake; when the whole country round the volcano, to the extent of 120 miles from north to south, and 60 miles from east to west, sustained an undulatory movement of extreme violence, which lasted four minutes. The effects were most fearful. In the districts near the mountain, every town was levelled with the ground, and the cities of Riobamba and Quero were buried under the ruins of the shattered mountains. The base of Tunguragua was riven

asunder, and streams of mud and water poured forth from numerous apertures, filling the valleys to the depth of 600 feet. Fetid exhalations were emitted by the Lake Quilotoa, from whence flames also are related to have issued. The whole face of the country was changed, partly by the throwing down and levelling the more elevated portions, and partly by the layer of mud which covered everything, and blocked up the channels of the rivers. During this eruption, vast numbers of the curious species of fish, called the Pimelodes cyclopum, were found in the ejected water of the volcano. The phenomenon of the eruption of fishes is not, however, peculiar to this volcano, having occurred in Cotopaxi, and also in Imbaburu. These fish are considered by De Humboldt, to be identical with some found in the rivulets at the base of the volcanos. On some occasions, millions have been seen descending from Cotopaxi, either from its summit, or from apertures in its sides, with great masses of fresh cold water, nor do they usually present the appearance of having been exposed to the action of great heat.

Continuing our northward route, and entering New Granada, we find three volcanos in the province of Pasto, and three in that of Popayan. The connexion of the volcanos of Pasto with the district of Tunguragua, was strikingly displayed in 1797. A column of black smoke had continued for several months to issue from the Volcano de Pasto, but, to the surprise of the inhabitants of the neighbouring region, the smoke suddenly disappeared on the 4th of February. It was afterwards ascertained that this happened at the precise moment, when, at the distance of 135 miles, the city of Riobamba was, as we have just seen, destroyed by a tremendous earthquake.

The great volcanic chain having hitherto pursued its course nearly due north and south, at this point takes a wider spread, extending over the whole of the Caribbean Sea, which is supposed to be one continuous district of volcanic action; numerous instances of subsidences and upheavings of land, and other consequences of earthquakes, as well as volcanic eruptions, being on record in the islands it contains. The line or band

of volcanos may, however, be considered as being more especially continued in Central America, which is subject to the most fearful convulsions of the earth, and in which territory, nineteen active volcanos occur; the most elevated of these being the water volcano, 12,600 feet above the sea, which has never been known to emit fire from its crater; the eruptions having always consisted of torrents of water and stones.

Among the severe earthquakes on record are those which have at two different periods destroyed the city of Guatemala. The destruction of this place in the year 1773 was of singularly awful character. It was built close to a volcano; and during an eruption of the latter, an abyss opened, when the whole city and its inhabitants were swallowed up, every vestige of its former existence being entirely obliterated.

A very remarkable eruption took place on the 19th of January, 1835, in the volcano of Coseguina, situated in the Bay of Fonseca (usually called the Coast of Conchagua). The eruption was preceded by a rumbling noise, accompanied by a column of smoke, which issued from the mountain, increasing until it assumed the form and appearance of a large and dense cloud, which, when viewed at the distance of 30 miles, appeared like an immense plume of feathers, rising with considerable velocity, and expanding in every direction. Its colour was at first of the most dazzling whiteness; but it gradually became tinged with gray; then passed into yellow; and finally assumed a beautiful crimson hue. In the course of the two following days, several shocks of earthquakes were felt, some of great severity. The morning of the 22nd rose fine and clear; but a dense cloud of a pyramidal form was observed in the direction of the volcano. This gradually ascended; and by eleven o'clock, A.M., it had spread over the whole firmament, entirely obscuring the light of day, the darkness equalling in intensity that of the most clouded night, so that the nearest objects could not be discerned. The cattle hurried back to their folds; and the fowls went to roost. This darkness continued, with little intermission, for three days, being interrupted only by a lurid light which occasionally

gleamed, or by flashes of lightning, accompanied by tremendously loud thunder-claps, sometimes occurring in regular succession, like the discharge of large pieces of ordnance. During the whole of this fearful obscurity, a fine black powder continued to fall; and when light again dawned upon the terrified inhabitants of the neighbouring towns, an extraordinary spectacle presented itself; every tree, every house, every individual, was so covered with this black dust, that neither form nor feature could be recognised. It was also deposited on the ground in some parts to the depth of ten feet.

The darkness extended over half of Central America; and above 40,000 square miles are said to have been covered with fine dust, ashes, and lava. It also appears, that some effects of this tremendous eruption extended to the distance of a thousand miles in every direction round the mountain. The detonations which accompanied the eruptions were tremendously loud, also extending to a remarkable distance: and it is a singular fact, that wherever they were heard, the sounds were supposed to proceed from some cause in the immediate vicinity. Thus, at Kingston in Jamaica, 800 miles from Coseguina, these reports were mistaken for signals of distress from the British sloop Fly, then lying off that port; but the fall of ashes, subsequently led to the conclusion, that the reports proceeded from a volcano. Immense numbers of cattle perished on this occasion; but it does not appear that any human lives were lost. Nay, even good sprang from this seeming evil; for it is a remarkable fact, that the fine volcanic dust thus spread over the plains, so far from injuring vegetation, appeared to produce an entirely contrary effect, and to render the plains abundantly fertile.

By this convulsion, the outline of the coast was changed, the course of a river turned to an opposite direction, and two new islands were formed in the Bay of Fonseca, at a distance of about two miles from the volcano.

It is remarkable that phenomena precisely analagous to those exhibited on this occasion at Coseguina, occurred in an eruption of the volcano of Iraru, or Cartago, which took

place in 1728, and which is described as having been attended with violent earthquakes, and with *a dense black fog, which lasted for three days.* The volcano of Cartago was again in eruption on the 2nd of September, 1841, being accompanied by a terrific earthquake, which destroyed the city of the same name, burying in its ruins about forty or fifty of the inhabitants. The city of Cartago contained a population of 10,000 souls, but owing to the attention paid to the construction of the buildings in modern times, these fearful visitations are happily usually less destructive than in more remote periods.

The great volcanic band next enters Mexico; here, however, taking a transverse direction, and crossing the elevated land, which forms the continuation of the Andes and Rocky Mountains. In this region, volcanic forces are exhibited in at least equal energy, and indeed, the whole table-land is supposed to owe its present form to volcanic eruptions, as it appears originally to have consisted of a series of granite valleys, which have been filled to the depth of several thousand feet, by various volcanic products.

The chain of active volcanos which crosses this table-land from east to west, commences on the coast of the Mexican Gulf, with the small, but energetic Tuxtla; next to Tuxtla, is the vast cone of Orizaba, 17,375 feet above the sea; and beyond this, the lofty Popocatapetl, 17,716 feet above the sea. These lie to the east of the city of Mexico; on its west are the cones of Jorullo and Colima. These volcanos are all active: and at no distant period, the snow-clad summits of Iztaccihuatl, of Toluca, and of Tancitara, situated in the same line, were also burning. These three mountains, as well as Orizaba and Popocatapetl, rise far above the limit of perpetual congelation; and from the snowy peaks of the two latter, smoke continually issues.

The most remarkable volcano in this region, however, is that of Jorullo, or Xorullo, the formation of which is not of older date than the middle of the last century. The site of the present volcano is about 100 miles from the sea, and, previous to the year 1759, consisted of some remarkably fertile

fields, covered with flourishing plantations of indigo and sugar-cane, watered by two small streams. In the month of June of that year, subterranean sounds of an alarming nature were heard, attended by earthquakes, which continued for two months, when a temporary cessation occurred: but, on the 28th of September, the sounds recommenced with increased violence, and, during that night, a surface of ground, from nine to twelve miles in extent, rose up like an enormous bladder, to the height of above 550 feet: flames issued from the ground, and fragments of rock were thrown to a great height, accompanied by eruptions of mud; whilst the softened earth was observed to heave like the billows of the sea. The two little rivers poured their waters into the chasm, disappearing below the eastern extremity of the plain, and re-appearing as hot springs at its western limit. Six volcanic cones were formed, the smallest of which was 300 feet in height, and Jorullo, the central volcano, was elevated to the height of 1695 feet above the level of the surrounding plain*.



Jorullo.

Thousands of small cones, or mounds, called by the natives

* The elevation of the summit above the sea is 4267 feet.

hornitos, or little ovens, were formed on the surface of the agitated plain, each of which sent forth columns of sulphureous vapour: this they continued to emit for many years; but it appears that this action has now altogether ceased, and also that no eruption has occurred in Jorullo since 1803. Vegetation is even making great progress on the sides of this recent volcano, and the fertile plain is again covered with luxuriant crops of indigo and sugar-cane. De Humboldt has remarked, that this is perhaps one of the most remarkable physical revolutions in the annals of our globe; and yet, striking as it is, it almost yields in sublimity to the mighty movement effected by the Chilian earthquake of November, 1822.

To the north of Mexico, we meet with at least one active volcano, situated in north latitude 28°, in Lower California. Some accounts state that there are three, or even five volcanos in this region; but this territory is little known. As far, therefore, as our present information extends, this may be regarded as the termination, northwards, of the volcanic band in its full energy; though, as we shall presently find, some traces of volcanic activity extend further in that direction. Let us, however, now turn our attention to the volcanic area of the Caribbean Sea, and the adjacent shores.

The coast of Caraccas has, at various periods, suffered severely from earthquakes. Cumana was destroyed by an earthquake in 1796; and a similar catastrophe befell the city of Caraccas, on the 26th of March, 1812, when that city and seven other towns, were almost totally laid in ruins, and nearly twenty thousand persons perished. This terrible convulsion extended to a great distance, for, besides violently agitating the whole of the Caraccas, a severe earthquake visited the island of St. Vincent, and convulsed the valley of the Mississippi for the length of three hundred miles. So violent was the agitation in the latter locality, that large lakes, twenty miles in diameter, were formed in the course of an hour, and others as rapidly drained; deep chasms yawned in the earth; and the ground on which the town of New Madrid is built is said to have sunk eight feet below its former level.

The greater number of the West Indian Islands appear to to be of volcanic origin, and there are active volcanos in St. Vincent's and Guadaloupe, as well as solfataras on some of the other islands. An eruption took place in the volcano of Morne Garou, in the island of St. Vincent, in April, 1812, at which time nearly all the plantations on the island were destroyed. Earthquakes of great violence are not unfrequent in these islands, particularly in a line extending from Jamaica to St. Domingo and Porto Rico. A severe earthquake occurred in St. Domingo in 1751, when the face of the island is described as having been quite altered; mountains appearing where there were valleys; valleys where there were mountains; lakes where there were villages; and a new course being given to several rivers. Another severe convulsion occurred in the same island in 1770.

The volcanic region which we have now traced from the south of Chili, or perhaps from the island of Deception, to California and New Madrid, appears in South America to be chiefly confined to the western regions, no indications of volcanic disturbances having been observed in Guiana, Brazil, or Buenos Ayres. The remarkable volcanic formation near the River Santa Cruz, in Patagonia, is probably referable to a more ancient geological era*. In the eastern districts of North America, earthquakes are by no means of rare occurrence. We have already mentioned, that the valley of the Mississippi was convulsed at the period of the earthquake which destroyed Caraccas, in 1812; South Carolina, at the same time, was also much convulsed.

Springs of inflammable vapour have been discovered in several parts of North America. The village of Fredonia, in

* This remarkable volcanic formation consists of an immense stratum of lava, which forms a plain extending in every direction, and being about one thousand feet above the bed of the river, whilst, in some parts, black lava cliffs, and masses of basalt, rise like frowning castles. "Wonderful indeed," says Captain Fitz-Roy, "must have been the immense volcanic action which spread liquid lava over such an immense tract of country!"

the state of New York, is lighted by a natural discharge of gas, which is collected by means of a pipe into a gasometer.

Earthquakes are very frequent on the shores of the St. Lawrence, often of sufficient violence to split walls and throw down chimneys. Such effects were experienced in December, 1791, at St. Paul's Bay, about fifty miles from Quebec.

These convulsions and indications of subterranean heat, appear, however, insignificant, in comparison with the stupendous volcanic forces we have been considering: nor can we regard them as a distinctly-marked continuation of the vast volcanic band. Whether future researches may disclose its prolongation in the more western parts of North America, is still matter of uncertainty, but traces of more decided volcanic action have been observed in this portion of the continent. Thus, near the source of the Missouri, amid the snow-clad summits of the Rocky Mountains, two peaks are said to occur, which emit smoke in considerable volumes, apparently from volcanos in a state of eruption. Boiling springs are also met with in the same vicinity. Traces of volcanic action have likewise been noticed in the Spanish River Mountains, and other parts, lying between the Rocky Mountains and the Pacific; in which locality we also meet with the elevated volcanic cones of Mount Fairweather, fourteen thousand feet in height, and Mount St. Elias, sixteen thousand feet above the level of the sea. The two last-mentioned volcanos appear to be connected with the volcanic region of the Aleutian Isles, which, it will be remembered, form the northern commencement of the Asiatic volcanic region, and which thus appear to form a link, connecting the Old and New World.

CHAPTER XXIII.

OCEANICA.—AUSTRALIA.—NEW ZEALAND.—POLYNESIA.—POLYNESIAN VOLCANIC REGION.—CONCLUSION.

> . . . Through hardy enterprise
> Many great regions are discovered,
> Which to late age were never mentioned
>
> SPENSER

OCEANICA, under which appellation may be included Australia, New Zealand, and the Polynesian Archipelago, forms another grand division of the globe.

The vast island of Australia, or New Holland, is about two thousand four hundred miles in length, and its width varies from one thousand two hundred, to one thousand four hundred miles. This extensive tract of land does not appear to be traversed in its interior by any elevated mountain system; but, on the contrary, its principal mountain ranges border upon its shores, apparently encircling it on every side, and giving it, in this respect, some resemblance to Arabia and Persia. Finding that this region is possessed of this one natural feature in common with those territories, we shall be desirous of ascertaining whether any other similarity occurs; and upon inquiry we shall learn, that Australia, like Arabia and Persia, is remarkable for its deficiency of water; apparently not possessing any important river, excepting, perhaps, in the north-western districts, and being, in some parts, subject to great droughts. The most characteristic feature of this region, however, seems to be the extensive lowland, which is supposed to occupy a very large portion of the interior.

The extreme south-eastern angle of Australia appears to enjoy a more agreeable climate than any other part of this vast island. Its greater distance from the equator gives it the advantage of a cooler temperature; to which the snowy mountains, called the Warragong Mountains, or Australian Alps, which are situated in this district, also contribute.

Being, likewise, surrounded on three sides by the sea, it possesses an insular climate, and abundant supplies of rain. Extensive downs occur, covered with excellent pasture; and some districts of so "fascinating a character," that Major Mitchell has bestowed on the country to the south of the River Murray the appellation of "Australia Felix." The hills are generally of a conical form, and the rocks of which they are composed consist almost wholly of lava; a circumstance to which the greater fertility of this region may perhaps in part be attributed. Mount Napier, situated between Portland Bay and the Grampian Mountains, contains a crater, the first hitherto discovered in Australia. This mountain is surrounded for several miles by a rock of volcanic formation.

The Grampian Mountains may be considered as the commencement of a mountain system, which, running nearly parallel with the eastern coast of Australia, extends to Cape York and Endeavour Bay. The highest summit in this range is Mount William, four thousand five hundred feet above the sea. In the parallel of Sydney, the range bears the name of the Blue Mountains. The mountains in this part do not appear to exceed three thousand feet in height, but, owing to the precipitous character of their surface, their more elevated parts are very difficult of access. The Liverpool range, which branches off to the westward, is of totally different character, the summits of this range consisting of rounded hills, or flat plains, covered with grass. The Hardwick range takes a northerly direction, and some of the loftiest summits in Australia appear to be situated in this part.

To the westward of this mountain system, a series of terraces occurs, which may be considered as the declivity of these mountains. These terraces consist of plains, of greater or less extent, separated from each other by low ridges; each ridge presenting a different geological formation. The terraces are destitute of timber trees, but are covered with luxuriant herbage, affording abundant food for cattle and sheep*.

* The greatest part of the wool exported from Sydney, and which is esteemed of superior quality, is furnished by the sheep of this district.



Beyond the terraces, the lowlands commence, the extent of which is yet unknown. These plains are in many parts extremely level, though in others they are slightly undulating; and they appear to have a general slope towards the south. In some districts, they are wholly destitute of vegetation; whilst, in others, saline plants occur, without an intervening blade of grass. Some of these plains are covered with *polynum*, a gloomy and leafless bramble; and in others, as far as the eye can reach, nothing is met with, except one kind of bush, forming a thick scrub. The richest soils in this part scarcely produce anything better than a small number of stunted eucalyptus, or gum-trees, and cypresses; though a few highly-favoured spots are covered with good herbage, and trees of better growth.

The scenery in the Blue Mountains is of singular and striking character. These mountains consist principally of a succession of sharp ridges, intersected by remarkably abrupt and narrow ravines, or gulleys, some of which are little less than 2000 feet in depth. Many of these ravines constitute the beds of rivers; and in some parts, numberless small cascades pour down the almost perpendicular sides. A chasm, or ravine, of this description, of great depth, but not more than 300 feet in width, forms the bed of the River Grose, a tributary of the Hawkesbury. Near one of the sources of that river, occurs the cataract, called Govatt's Leap; which, although the body of the water is inconsiderable, is remarkable for its great depth, and also for the character of the surrounding scenery. This cataract consists of a succession of cascades, the first of which is precipitated over a perpendicular rock, about 200 feet in height; and the entire fall to the bed of the river is estimated at full 1200 feet.

A remarkable burning mountain, called Mount Wingen, is situated on the eastern declivity of the Liverpool range. It was discovered to be in a state of incandescence in 1818, and the process appears to be still (or was until very lately) maintained in full force. The mountain is composed of a solid mass of sandstone, and the fire extends over an area of about

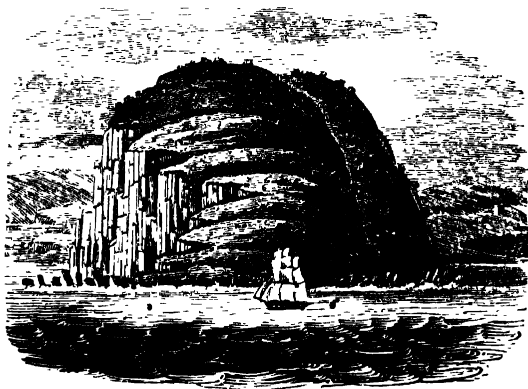
an acre and a half. Throughout this space, several chasms, or fissures occur, from which volumes of smoke, accompanied by brilliant flames, are perpetually issuing. The principal of these fissures was, in the year 1831, about two feet in width, and on looking down this chasm, the sides of the rock are described as having been "of a white heat, like that of a lime kiln; whilst sulphureous and steaming vapours arose from the aperture, amidst sounds which issued from below, like blasts from the forge of Vulcan." The sides of the chasms were adorned with efflorescent crystals of sulphur, varying in tint from the deepest orange to a pale straw colour. No lava, or any other volcanic products, were observed in the vicinity of this mountain.

Southern Australia appears, like Eastern Australia, to possess one of the characteristic features of the whole region, that of a ridge of mountains bordering on its shores, with a belt of country, of greater or less extent, and varying in fertility, lying between their base and the ocean. The same remark applies to Western Australia, where we meet with a succession of mountain ranges, running nearly parallel with the coast, and with each other. The Rugged Mountains find their southern termination near St. George's Bay. The granite range of the Darling Mountains commences at Cape Chatham; and the less elevated Roe's range at Cape Lewin, all more or less taking the line of the coast. At the northern extremity of the Darling Mountains, and about thirty miles to the eastward of that range, rises the Victoria range, between the base of which and the sea extends a large district of fertile country, to which the name of Victoria Province has been given. Another range has also been observed, branching off in a westerly direction from the Darling Mountains, and forming the northern boundary of a remarkably well-watered district, immediately to the north of Perth. In some parts of Western Australia, however, the land is poor and sandy, though usually diversified with rich tracts near the principal streams; and in the latter districts, the fruits, both of warm and temperate zones, thrive luxuriantly. The interior of the

country, as far as it is known, assumes, generally, a level character, and is covered with excellent pasture, and in some parts with forests, producing valuable timber.

The north-westren angle of Australia appears to contain some highly beautiful and fertile spots. On the coast, the general character is that of rocky sandstone hills, about 300 feet in height, covered with brushwood and prickly grass, but intersected by beautiful valleys, with a fertile soil and abundant supplies of fresh water. Further in the interior, the country in this part is described as of an unusually rich and fertile character, though generally flat, and traversed by rivers of some importance.

Van Diemen's Land, or Tasmania (so called from its discoverer Tasman), consists generally of an alternation of hill and dale, almost every part of the island being adapted either for pasture or for cultivation. A mountain range, called the Western Mountains, traverses the interior, in some parts reaching the elevation of 5000 feet. Table Mount, which nearly overhangs Hobart Town, though less than 4000 feet in height, is covered with snow for two-thirds of the year. The



Cape P[illegible]ar V[illegible]n D[illegible]

south-eastern portion of the coast is intersected by lagoons, much resembling the voes of the Zetland Isles, and forming excellent harbours; and the deeply-indented peninsula of Tasman, (at the extreme point of which rises the remarkable basaltic formation of Cape Pillar,) though of great extent, is only connected with the main land by a narrow isthmus, a few hundred feet in width. Van Diemen's Land, as we have already seen, enjoys a mild and equable climate; and the trees in this island attain the most magnificent dimensions, especially the eucalyptus and acacia trees, and the arborescent ferns; the latter, even in this latitude, growing to the height of thirty feet, which fronds twelve feet in length.

The mineral deposits of a considerable portion of Australia are yet unexplored. Some beds of coal have, however, been discovered; this valuable mineral having been met with near Newcastle, situated to the north of Sydney, where it is associated with the remains of fossilized trees, and with iron-stone nodules, containing impressions of leaves: and carboniferous or coal-bearing rocks have been recently observed, occurring in Victoria Province. Coal is also met with in considerable abundance in Van Diemen's Land.

In no part of the known world do we meet with so peculiar and so remarkable a flora as in Australia. Some trees occur, having their leaves twisted out of what appears their natural position; others with leaf stalks performing the office of leaves; others having fruit with the stone placed on the outside; plants belonging to parisitical orders, growing on the ground; and, from the very remarkable construction and appearance of a leguminous plant (a species of acacia), a Dutch botanist actually mistook it for a fern: indeed, so singular and peculiar is the aspect of many of the plants belonging to this region, that the eye of an experienced botanist is required to determine their true botanical character. In the eastern districts of Australia, however, the vegetation assimilates in some degree to that of South America; in the western districts, to that of Southern Africa; and, in the northern districts, yet nearer to that of the islands of the Indian Archipelago, the



Australian Forest Scenery

prevailing trees in the latter district, consisting chiefly of the seaforthia and other palms, the Cycas media, and the arborescent fern (fig. 213); whilst the mangrove lines the swampy shores near Port Essington.

Among the plants more particularly characteristic of Australian scenery, are the eucalyptus (fig. 14), of which there are several species, commonly known under the general name of gum-trees. These trees, in some parts, acquire splendid dimensions, and the brown gum-tree yields the timber called Australian mahogany. These trees, and the various species of acacia, or wattle-trees (fig. 73), with their countless yellow tufted flowers, form the prevailing trees in Australia. Some of the acacias present very extraordinary forms, being destitute of leaves, or having leaves of the most singular shape; and "the daviesias," says Professor Lindley, "rival the acacia itself in the strangeness of their foliage; daviesia quadrilatera has leaves which look more like objects prepared to puzzle a geometrician, than like any already known in the vegetable kingdom." The casuarina, or swamp oak (fig. 106), which is remarkable for its long weeping thread-like branches, appearing like the stem of an equisetum, forms the "beef-wood" of the colonists, and occurs in great abundance in the south-western districts. In the same part, plants of the order proteaceæ are very prevalent, presenting many genera and species of the most varied appearance, as well as surpassing beauty; among these, one species of banksia (fig. 116), is said to have a trunk fifty feet high, and more than two feet and a half in diameter. The zamia genus (fig. 139), which, like the preceding order, occurs in Southern Africa, also inhabits these western districts; and one species is described which frequently attains the height of thirty feet. The xanthorrhea (fig. 193) is another native of these districts, and, with the banksia and zamia, forms groups that impart to some parts a character perfectly tropical. The Araucaria excelsa, or Norfolk Island pine (fig. 157), which grows in the eastern districts of Australia, is one of the most lofty trees known to exist, apparently only rivalled in height by the Californian pines. The panda-

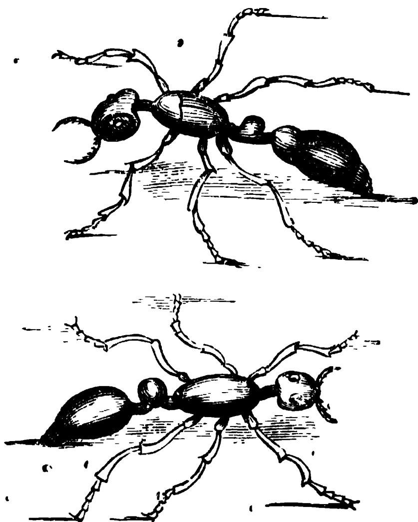
nus, or screw pine (fig. 199), grows only within the influence of the sea-breezes, and extends its range to most of the islands of Oceanica, being particularly abundant in the Caroline Islands, where, as we have before noticed, it forms the staple food of the inhabitants. In addition to the plants above enumerated, we may mention the grass-tree (fig. 195); gigantic thistles eleven feet high; and arborescent nettles from fifteen to twenty feet high; besides the Nuytsia floribunda, which is a most curious instance of a plant, belonging to the parasitical order loranthaceæ, growing on the ground. This plant is said to attain the stature of a small orange tree, and such is the abundance of its orange-coloured blossoms, that the colonists at King George's Sound compare it to a tree on fire; from whence it has obtained the name of the "fire-tree." The plants at present known, which are adapted for the food of man, are not numerous: besides the pandanus, one of the principal is the chesnut-bean, the fruit of which is much eaten by the natives. The beans are contained in long pods, and are larger than the Spanish chesnut, to which, when roasted, they are said to approach in flavour. An esculent vegetable is mentioned by Dr. Milligan, as occurring in Western Australia, known by the name of "boom," which he describes as a root of a scarlet colour, resembling tulip roots in size and form. The natives, he observes, "roast them in the ashes, and then pound them between two flat stones; when thus prepared, they are mucilaginous, and of a glossy black colour; they may be considered as the bread of the natives who live near the coast." This "boom" is supposed by Professor Lindley to be the bulb of a species of drosera, which stains paper of a brilliant deep purple, and appears likely to be of commercial value for dyeing purposes. Many of the myrteaceæ are remarkable for the fragrance of their leaves; and Professor Lindley mentions one small genus, included among the Swan River plants, to which, from the exquisite sweetness of its foliage, he has given the name of *hedaroma*. "The leaves, and especially the half-ripe fruit, of these plants," he remarks, in speaking of the hedaromas, "preserve their fragrance so well, that they might be worth collecting for the use of the perfumer; and, if so,

they would furnish a new and most agreeable article of luxury to Europe, and a small aid to the natural resources of the colony." The orchideous plants are very numerous, and, from the singularity of structure, beautiful forms, large size, gay colours, and fragrance of many species, the whole assemblage is scarcely surpassed by those of tropical countries.

Among its native animals, Australia possesses a very small number that are of utility to man, this extensive region being apparently entirely destitute of ruminant animals, such as the cow, deer, sheep, &c., and of pachydermatous animals, such as the hog, horse, &c.; whilst four fifths of its native quadrupeds belong to the order marsupiata; and all hitherto discovered are peculiar to this portion of the globe. Among the marsupial animals we find the kangaroo (fig. 45), of which there are several species; the kangaroo rat, the wombat (fig. 46), the petaurus, or flying opossum (fig. 47), and the bandicoot, all of which feed principally on leaves and roots of plants; whilst the opossums are carnivorous animals; and among the latter, the thylacurus, and the dasyurus, or hair-tail, often commit great ravages among the sheep of the settlers. The Australian quadrupeds also include among their number that very singular animal, called the ornithorynchus, or duck-bill (fig. 64); and the echidna, one species of which, the spiny echidna (fig. 65), is covered with prickles like those of the porcupine.

Although the birds of Australia are not so peculiar as its quadrupeds, they include some rare and singular forms. Such are the emu (fig. 126), the black swan (fig. 137), and the menura, or lyre-tail. The *Tulegalla lathami*, or brush turkey, is not less remarkable for the singularity of its habits. This bird does not hatch its own eggs, but employs for that purpose similar means to those used for artificial incubation. For some weeks prior to the period of laying, it collects together an immense mass of vegetable matter, varying from two to four cart-loads, with which it forms a pyramidal heap; in this heap it deposits its eggs, about eighteen inches deep, and from nine to twelve inches apart. The eggs being carefully covered, are

then left to hatch by the heat arising from the decomposition of the surrounding matter. These heaps are formed by the united labours of several pairs of birds, and frequently contain a considerable number of eggs. Both the eggs and the flesh of the bird are valuable as articles of food. Doves and pigeons are very abundant; and some of the species are remarkable for their beauty. The most common birds, however, appear to be various species of the *melliphagous* or honey-sucking family, which feed on the honey of flowers. Cockatoos, parrots, and parrokeets are very numerous; and the latter prove very destructive to the crops of corn. In Van Diemen's Land a species of parrot occurs, called the black-spotted ground parrot, which is remarkable for walking on the ground, and never perching on trees. In the latter island we also meet with that extraordinary bird, the apteryx: the habits of this bird are entirely nocturnal, in which respect it resembles the marsupial animals, the greater number of which seek their food by night.



Australian Black and Red Ants.

Considering the extent of this region, the insects tribe do not appear to be numerous. Like most warm countries, however, Australia abounds with ants; and some species are eaten by the natives. The great black and red ants are described as very formidable, being armed with a sting, with which they inflict a severe wound. The accompanying cut represents them of their natural size.

On the northern coasts, the *trepang*, *beche de mer*, or sea-slug, is very abundant. This singular article of luxury on the table of the Chinese epicure appears to bear much resemblance to our large common slugs, the skin of the beche de mer being rough and toughish, and there being two species, the one black and the other gray. In length these sea-slugs vary from eight to twelve inches, and they are about five inches in girth. They are generally found among the sea-weed, or on the sand-flats in shallow water. When taken out of the water, they feel stiff, but their soft bodies consist of a mass of gelatinous substance.

The islands which constitute the territory of New Zealand, though lying nearly parallel with the southern districts of Australia, possess a far more temperate climate than any part of that region; this diversity arising from the difference in the configuration of the surface. These islands being surrounded on all sides by the waters of the ocean, and traversed by elevated mountain ranges, not only enjoy an insular and milder climate, but also are furnished with abundant supplies of water. The northern island especially is a remarkably fine fertile country, being beautifully diversified with hill and dale, often clothed with the most luxuriant forests; whilst in the southern districts, the snow-capped mountains in some parts attain the elevation of 14,000 feet above the sea level, the whole combining to form a scene equally rich and magnificent.

Ferns form a very prominent feature in the vegetation of New Zealand, a large portion of the country being covered with one species, the roots of which are used for food; whilst the arborescent fern holds a conspicuous place in the woods; though the latter also contain several valuable timber trees, among which is the *Dammara australis*, or kauri pine, called

also the cowdie pine, which produces both excellent timber and a fragrant gum resin, equal or superior to gum mastic. Among the more important productions of these islands is the Phormium tenax (fig. 194), commonly called New Zealand flax: the plant, however, bears no resemblance to the flax, or *linum**, the leaves being similar to those of the iris. This plant is remarkable for the strength of its fibres, which form very good cordage.

The native animals of New Zealand are few, the only mammiferous animals being bats; and no other native quadruped, except a small lizard about six inches in length, is known to exist in these islands. Rats are found in great numbers; but these are considered to have been accidentally introduced, by the first ships that touched at the island. The zoology of the whole of the Polynesian Islands is, in this respect, similar to that of New Zealand; and a remarkable natural division is formed between the Polynesian and Indian Archipelagos, by the marked difference of their native animals —the whole Polynesian region being destitute of quadrupeds of any size, whilst the Indian Islands abound in large and ferocious mammalia, either identical in species with, or nearly resembling those occurring on the adjacent continent. Among the birds of New Zealand the most remarkable is the apteryx, which has been already mentioned as occurring in Van Diemen's Land.

Nearly due south of the western island of New Zealand, is situated the Antarctic mainland, discovered by Captain James Ross on the 12th of January, 1841, and to which he has given the name of South Victoria Land. "It rose," says Captain Ross, "in lofty mountain peaks, of from 9,000 to 12,000 feet in height, perfectly covered with eternal snow; the glaciers that descended from near the mountain summits projected many miles into the ocean, and presented a perpendicular face of lofty cliffs. We pursued our course along this magnificent land, still steering to the southward, and on the 28th [of January], a mountain of 12,400 feet above the level of the sea was seen,

* See fig. 33—Russia.

emitting flame and smoke in splendid profusion. This magnificent volcano received the name of Mount Erebus. It is in latitude 77° 32′ S., and longitude 167° E.; an extinct crater to the eastward of Mount Erebus, of a somewhat less elevation, was called Mount Terror. The mainland preserved its southerly tending, and we continued to follow it, until, in the afternoon, when close in with the land, our further progress in that direction was prevented by a barrier of ice: this extraordinary barrier presented a perpendicular face of at least 150 feet, rising, of course, far above the mast-heads of our ships, and completely concealing from our view everything beyond it, except only the tops of a range of very lofty mountains in a south-south-east direction, and in latitude 79° S. Pursuing the examination of this splendid barrier to the eastward, we reached the latitude of 78° 4′ south, the highest we were at any time able to attain*." The continuity of this newly discovered southern land was traced from nearly the 70th to the 79th degree of latitude.

The islands of Polynesia, which occupy so large an expanse of the Pacific Ocean, may be divided into three classes,—the *mountainous*, the *hilly*, and the *low* islands. The *mountainous* islands are evidently volcanic, and vary in height from 2000 to 15,000 feet. They are generally exceedingly picturesque in their appearance, combining the grand with the beautiful, the country at the base of the mountains usually presenting a series of fertile valleys, covered with the most luxuriant vegetation and magnificent trees. The *hilly* islands are of coral formation, and appear to have been raised above the waters of ocean by some elevatory movement. Their general character is that of fertility and beauty, but they do not possess the grand scenery of the mountainous islands. The third class comprises the *low* coralline islands, which are generally of small extent, and in most cases only a few feet above the level of the ocean. The soil on the latter islands is usually of little depth, and therefore scarcely

* The highest southern latitude that had ever been attained by any preceding navigators, was 74° 15′ S., which point was reached by our own countryman, Captain James Weddell

any trees are capable of thriving in these newly-risen islands. The cocoa-nut palm and the pandanus are, however, remarkably and beautifully adapted to take root and flourish in such situations; and, accordingly, we find these trees among the first occupiers of the soil. The admirable provision by which these islands become suitable for the habitation of man is strikingly apparent in this process; the seeds of these plants, protected as they are by a thick, but light shell, are capable of floating to a distance on the surface of the waves, and of being thus lodged uninjured on the newly-formed island. The roots of these trees are so remarkably hard, that they have the power of forcing their way among the interstices of the coral rocks; and both species are particularly adapted to thrive within the influence of the sea air. No sooner does the cocoa-nut cover an island than man may be supported on this spot; for this valuable tree furnishes him with food, clothing, sails, cordage, timber, materials for thatching his dwelling, &c.

The Friendly Islands, with the exception of the small active volcano of Tofua, consist entirely of low coralline islands. Tongataboo, the largest of the group, and indeed of the whole class, is not more than one hundred miles in circumference. In some instances, as in the group appropriately called the Dangerous Archipelago, these islands are partially covered by the waves, offering considerable impediments to navigation. In some parts, also, extensive coral reefs extend, either encircling the islands, and forbidding approach, or affording protection to the harbours.

The Society Islands are a very beautiful and fertile group, some of which belong to the mountainous, and others to the hilly class. Tahiti, or Otaheite, the largest of the group, which is of igneous origin, is a singularly beautiful island, containing grandly-formed mountains, the most elevated of which, named Oreana, rises to the height of about ten thousand feet above the level of the sea. Numerous cascades pour down from these elevated and picturesque mountains; and the scenery at their base is described as consisting of a succession of deep valleys, or glens, richly clad, in the interior, with

graceful arborescent ferns, and other tropical plants; and near the shores, with groves of cocoa-nut palms: whilst "the deep blue of the surrounding ocean, contrasted with the white foam of the breakers, dashing against the extensive coral reefs, completes the beauty of the scene." The Sandwich Islands, which are rather detached from the other groups, appear to be of volcanic origin, and Hawaii, or Owhyhee, may be considered as forming the centre of this volcanic region. The general aspect of these islands is that of boldness and sublimity.

The intertropical situation of the Polynesian Islands subjects them to the most intense action of the sun's rays, but the nature of their soil renders them healthy. Surrounded too, as they are, by a vast expanse of ocean, and in some instances diversified by elevated mountains, they enjoy a delightful climate; and, excepting the newly-formed coral islands, are furnished with abundant supplies of water; the climate of the latter, however, is tempered by the sea breezes. The beneficial effects resulting from the combination of heat and moisture, are evinced by the varied and luxuriant vegetable productions of these islands, which, indeed, are ranked among the most delightful and smiling regions on the surface of the earth.

Not only is the flora of Polynesia varied and beautiful, but also remarkably redundant in plants adapted to the sustenance of man. Allusion has already been made to the cocoa-nut, so valuable to the inhabitants of the low coral islands: the mountainous districts possess a plant of at least equal value, in the bread-fruit tree (fig. 96), which has been called the staff of life of the Polynesians. This beautiful tree bears three or four crops in the year; and, as there are several species, which ripen at different seasons, a constant supply is provided during the greater part of the year. The leaves also afford fodder for cattle; the bark is woven into cloth, the trunk yields valuable timber, and the sap answers all the purposes of pitch. Both the banana and plantain, here called the maia, are indigenous to these islands; and the mapu, or native chesnut, is another useful production. The yam, which is afforded by the root

of the Dioscorea alata, also ranks high among the esculent plants of these islands. Besides these, we meet with taro, which is the root of the Arum esculentum; pia, that of the Cheila tacca; and three species of ferns, which are useful for food. The sugar-cane is a spontaneous production; and there are several kinds of excellent fruits. The paper mulberry (fig. 92) is woven into cloth for garments; and the leaves of the pandanus are used in forming the beautiful finely-plaited mats, made by the Polynesians. A remarkable tree, called the tuitui, or candle-nut tree, abounds in the mountains, bearing nuts about the size of a walnut, which are used by the natives as candles. Having stripped off the shell, they perforate the kernel, and string a number of these on a rib of a cocoa-nut leaflet, and then light them. The tree also furnishes a substitute for painting oil, and for varnish.

Such are a few of the fruits of the earth, showered by the Creator on these favoured regions, where, if man be silent in His praise, well may we exclaim,

> Soft roll your incense, herbs, and fruits, and flowers,
> In mingled praise to Him, whose sun exalts,
> Whose breath perfumes you, and whose pencil paints.

But ere we condemn the thoughtless unconcern of too many of the untaught inhabitants of these regions, let us look at home, and consider whether we, who regard ourselves as possessing every advantage of instruction, who also regard ourselves as the "chief" among God's works, "for whom the whole creation smiles;" how far, whilst assuming to ourselves the character of "the head," we are ready both to acknowledge the Source from whence all we enjoy is derived, and to exercise our privilege of acting as "the heart, the tongue of all."

The Polynesian volcanic region demands a brief attention. Australia appears to present few indications of volcanic energy, though, as already mentioned, a crater has been observed on Mount Napier, and repeated shocks of an earthquake occurred in August, 1827, in Melville Island, situated near Port Essington, on the northern coast. A slight shock was also felt at Vittoria

in the same locality, on the 30th of June, 1841, and according to Mr. Earle, the natives state that they are not unfrequent; they say that they are caused by the Malays dancing! "What on earth can they mean?" observes Mr. Earle.

New Zealand contains several active volcanos: and the immense area,

> Where the vast Pacific smiles,
> Round ten thousand little isles,

appears to be one theatre of volcanic action; a considerable proportion of the islands being, as already mentioned, composed of volcanic rocks; whilst active vents are interspersed at intervals, and the whole region is subject to earthquakes. Indeed, this is a remark which may be extended to the whole Pacific Ocean. In the north are the Aleutian Isles; in the east, the Galapagos, and other volcanic groups; in the west, the Kurile Isles, Japan, and the whole Asiatic volcanic band; whilst in the south we meet with the magnificent volcano, named Mount Erebus, already alluded to, as having been discovered by Captain James Ross, on the 28th of January, 1841, and there appears reason to conclude that the convulsions in the Polynesian Archipelago are more or less connected with those in the volcanic region of the Andes.

We cannot pause to consider all the features of the Polynesian volcanic region, but must confine our attention to the island of Hawaii (called Owhyhee by Captain Cook), the largest of the Sandwich group. This island appears to consist of one mass of volcanic matter, in various states of formation and decomposition. It contains three remarkable mountains, —Mowna Koa, Mowna Roa, and Kiraueh. Mowna Koa is a volcanic cone, rising by a gentle ascent from Byron's Bay, to the elevation of 18,400 feet. Mowna Roa, which is 16,000 feet in height, contains at its summit a vast crater, six miles in circumference; but the mountain of Kiraueh, although not 4000 feet in elevation, is the most remarkable in this island, on account of the striking volcanic phenomena it exhibits.

The crater of Kiraueh consists of a vast sunken pit, nearly oval in form, and with almost perpendicular sides. This

volcano is prodigiously active; but no great eruption has taken place since the year 1787, at which period one of the most tremendous description occurred, lasting for seven days and nights, and on that occasion, above five thousand of the natives, who were marching to war, all perished. A less violent eruption took place at a new vent near this mountain, in 1832, when the earth opened and emitted liquid lava, a large portion of which was discharged into the crater of Kiraueh. The vegetation on the sides of the mountain at first appeared to have been wholly destroyed by the igneous matter; but about eighteen months afterwards the ferns sent forth new and more than usually vigorous fronds.

The late Mr. Douglas*, who visited Kiraueh in 1833, has described the scene presented by the interior of its crater, as singularly awful and magnificent. He descended to a ledge at the depth of 1062 feet in this fearful pit; where a space, about five miles in diameter, was covered with lava, the whole of which had apparently been recently in a state of fusion, though some portion was at that period hardened. This igneous mass appeared, in the process of cooling, to have been rent into pieces of every form and size, from gigantic rolls, like enormous cables, to the finest threads. Over this part of the pit were dispersed numerous small cones, or chimneys, which continually emitted smoke; and besides these little cones, there were three remarkable pyramidal masses, measuring about 900 feet at the base, and being from 20 to 25 feet in height. These cones had lateral openings, like the doors of a baker's oven, to which they altogether bore a close resemblance. By kneeling down on the ledge, it was possible to peep into these openings, and to witness "a terrific vacuity, a red hot atmosphere," varied only by the occasional ejection of volcanic matter through a lateral opening. The remaining portion of this pit consisted of two lakes of liquid lava; one about 900 feet in diameter, and the other above 3000 feet in length, and

* It was in Hawaii that this promising naturalist met with his untimely death; he was killed by a furious bull, whilst pursuing his botanical researches.

nearly 2000 in width. Both these lakes of fire flowed in a continued stream towards the south end of the pit, at which point was exhibited one of the most appalling and magnificent spectacles in nature,—a vast caldron of lava, in furious ebullition, rolling and tumbling in fiery waves, sometimes spouting up to the height of 60 or 70 feet, and rapidly hurrying along, until it precipitated itself through an arch about 400 feet in width, and 40 in height, into a yawning chasm of unknown depth. From this tremendous, but unseen, laboratory of nature, immense masses were thrown back with great violence, and literally spun into minute glass-like filaments, which were carried by the wind in all directions. The sound issuing from this archway baffled all description: "that of the whole steam engines in the world," says Mr. Douglas, "would be a whisper to it."

The phenomenon of an earthquake-wave occurred in this and some of the adjacent islands, on the 7th of November, 1837. At Byron's Bay, in Hawaii, the sea first retired, leaving a large portion of the harbour dry. Hundreds of persons rushed down to the beach to witness the novelty, when a gigantic wave came roaring to the shore, on which it fell with a noise resembling a heavy peal of thunder; and, rising 20 feet above high-water mark, it overwhelmed everything in its way,—houses, trees, cattle, and the unfortunate crowd of spectators; then again retiring, it carried out to sea a vast quantity of goods, and a considerable number of men, women, and children, who all would have met with a watery grave, but for the timely assistance of a British whaler at anchor in the bay. Fourteen individuals, however, perished; and the destruction of property was very great. No shock of an earthquake was felt on shore; but Kirauea was unusually agitated on the preceding evening, the fires having been suddenly extinguished, and yawning chasms having burst forth in previously tranquil places; the latter commotions being accompanied with loud detonations.

We have now completed our brief survey of the leading features of the Earth as it is: necessarily—from the narrow limits we have prescribed to ourselves, though yet more, from the vast magnitude of the theme—falling infinitely short of its mighty capabilities. We earnestly hope, however, that enough may have been said to inspire our readers with a desire of pursuing into further details a subject at once so interesting and so important. Happy should we be could we have succeeded in leading one individual mind to the perception of the manifold works of God, and of the wisdom with which they are all made, or in strengthening an already received impression, that the earth is full of His riches; could we have conveyed the slightest intimation of the order, beauty, and harmony of the whole—where link unites with link, and all combines to form one unbroken chain, one grand and comprehensive system.

. . . Among themselves all things
Have order; and from hence the form, which makes
The universe resemble God. In this,
The higher creatures see the printed steps
Of that Eternal Worth, which is the end
Whither the line is drawn.

This order, this harmony, and bond of union, so manifestly and beautifully displayed in the natural world, may also in some measure be found to exist in the busy world, where man forms the principal actor: and where all, in their several vocations, may not unfrequently, though sometimes, perhaps, unwittingly, reciprocally aid each other, whilst the whole is overruled to the benefit of the human species. In nothing is this more evident, than in all endeavours to extend our knowledge of the earth's surface. Science, and more especially geographical science, or Physical Geography, here leads the van; the scientific traveller is the first to penetrate into unknown and barbarous regions, often pursuing his course amid privations and dangers, which zeal and perseverance alone can enable him to encounter or overcome. His researches open the field for the devoted messenger of religion, by whose

means friendly intercourse is established with the natives, and light and civilization introduced. A mart is thus opened for the wares of the merchant; for, as soon as a barbarous people become civilized, they require clothing, utensils, and other manufactured articles; and thus, not only is our commerce extended, but employment also afforded for our manufacturing population at home. The intelligent missionary, again, residing in unknown lands, possesses frequent and favourable opportunities of adding to our stores of scientific knowledge, whilst the merchant spreads this information, and the benefits accruing from it, over the surface of the globe.

Nor are these the only advantages resulting from this friendly intercourse. Whilst we are the instruments in diffusing the blessings of peace, and the glorious light of Christianity, among the benighted inhabitants of remote and barbarous climes, the blessings are returned upon ourselves, on our own brave countrymen. "Wherever the missionary succeeds in obtaining even the slightest influence," says Captain Fitz-Roy, "there may the seaman go in safety." And that such happy results may be of permanent duration has been recently shown in so decided a manner in the Moluccas, that we cannot refrain from inserting the account. Some of these islands are still in heathen darkness, but others have long since embraced Christianity; and on one of the latter islands, *which had not been visited by any European for fifty years*, a great number of the inhabitants were recently found still to retain their religion, having small churches, in which native preachers officiated. The inhabitants of Vordati are, however, still unenlightened; and in 1827, a vessel which touched at that island in quest of provisions, was seized by the natives, and all the crew, with the exception of two youths, who were saved by the women, were inhumanly massacred. The inhabitants of the island of Kissa, on the contrary, are Christianized; and not long since, two English seamen, who had been cast away on the shores of New Guinea, and had been sold and re-sold among the heathen tribes, were purchased by the Christian Chief of Kissa, who not only gave them their liberty, but brought them to Banda, where they

were received on board a trading vessel, and enabled to return to their native country.

Such considerations, combined with others already adduced in a former page, cannot but lead us to regard Physical Geography as a science eminently calculated to impart benefit to man, both as an individual, and as a social being. The path of "Creation's golden footsteps," into which this science conducts us, also guides directly to the divine Author of Nature. There are "laid before us," says Bacon, "two books or volumes to study; first, the Scriptures, revealing the will of God; and then, the creatures, expressing His power, whereof the latter is a key to the former; not only opening our understanding, but opening our belief; in drawing us into a due meditation of the omnipotency of God, which is signed and engraven on His works."

It is not, however, "Omnipotency" alone that is "signed and engraven" on the works of Nature: Providential care and Infinite goodness are also inscribed in glowing characters; in many instances, in characters so plain that "he who runs may read;" but in others, displayed only by the aid of scientific investigation. The latter circumstance palpably shows the great advantage of our present science: for,

> Goodness, inasmuch as we perceive the good,
> Kindles our love, and in degree the more,
> As it comprises more of goodness in it.

And finally, the contemplation of so much that is lovely, so much that is excellent, has, when considered with reference to Him from whom it all proceeds, a direct tendency to improve and elevate the character; whilst the habitual acknowledgment of the hand of the Most High, in these His visible works, cannot fail to confirm and strengthen our trust and reliance in Wisdom, Power, and Goodness so infinite.

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